The Evolution of Culturally Variable Cognitive Traits

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ABSTRACT

This project examined the evolution of human cognitive and behavioural traits that vary across societies, drawing mainly on findings in the field of cultural psychology. While this field has made great advances in rigorously documenting cultural variation in human cognition and behaviour, relatively less work has examined how and why these cultural differences exist. This thesis aimed to contribute to the latter question by exploring connections among contemporary culturally variable traits and investigating the long-term historical dynamics of culturally variable traits. A novel method using artistic style to index changes in cognition through history found a dynamic pattern spanning the last six centuries in three Western countries, contradicting the assumption often found in the literature that cultural traits remain stable over long periods of time. This finding also contradicts the ecocultural hypothesis, which posits that culturally variable cognition emerged in Ancient Greece and Ancient China in response to differing subsistence methods, and suggests instead that cognition varies with levels of intergroup conflict. Further tentative evidence against the ecocultural hypothesis is found in a priming experiment, in which primes designed to simulate the aforementioned subsistence differences had no effect on participants' cognition. Finally, an analysis of cultural variation in experimentally determined cooperation and real-life tax evasion suggests that the latter may be driven by uncertainty avoidance, a hypothesis that was also tested experimentally. Future directions of work are discussed that would be conducive to our understanding of human normative cultural evolution.

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CHAPTER 1: INTRODUCTION

When some of my international friends came to visit me in Amsterdam, we walked into a narrow alley in the city centre, where about 100 other people were also trying to get through. To good Dutch custom there was much pushing and shoving, accompanied by loud complaints about elbows in the back. We had no choice but to adjust, so we elbowed our way through as well. Having lived in England for a few years at that point, I was aware of the lack of courteousness and orderly cues and felt embarrassed about this blunt Dutch behaviour. But, rather than being annoyed, my friends remarked that they liked the Dutch rudeness, because they felt that things get done a lot faster.

There is no question that people from some cultures value efficiency over courteousness, while people from other cultures would not dream of sacrificing harmony for haste. How did people from different parts of the world come to feel differently about such topics? Despite the enormous advances cultural psychology has made in the mapping of differences in human cultures, the question of how and why these differences came about remains unanswered (Heine & Norenzayan, 2006; Matsumoto & Yoo, 2006).

Evolutionary theory derived from biology can be incorporated to answer these *why* questions (Mesoudi, 2011). However, before attempting to develop separate evolutionary accounts for each of the uncovered cultural dimensions, cognitions, modes, traits and behaviours, it should be established if there are *patterns* in the available data. If part of the large number of known cultural factors can be synthesised into internally coherent patterns, evolutionary theories for these patterns instead of separate factors could be developed. Such an approach would greatly

reduce the number of variables under investigation and thus increase efficiency. Then cultural evolutionary theory, which has already made great progress in more tangible areas of human culture, can be incorporated to explain the origin and evolution of culturally diverse psychological constructs (Mesoudi, 2011).

The aim of this thesis is to contribute to evolutionary research in cultural psychology, by (i) deducing patterns between contemporary cultural traits and behaviours between which synthesis could be enhanced, and (ii) investigating timescales on which cultural constructs play out, in order to elucidate the origins of those patterns. Both of these aims ultimately promote the goal of fostering greater integration between the fields of cross-cultural psychology and cultural evolution, which will facilitate the study of how culturally variable cognitions evolved.

These two core topics are reflected in the two parts of Chapter 2. The first part of Chapter 2 focuses on the current state of the field of cultural psychology and describes findings in some of the main cultural dimensions studied in the field. The goal is to identify links between these dimensions and gaps in our knowledge. In the second part of Chapter 2 three current evolutionary theories for the divergence of culture are discussed: the parasite-stress hypothesis, the environmental variability hypothesis, and most importantly for this thesis the ecocultural hypothesis. Chapter 2 concludes with considerations for theorising about the evolution of culturally variable psychological constructs. Using a novel method, Chapter 3 maps the temporal change in two cultural dimensions between the 15th century and the present. This method allows for testing patterns predicted by the ecocultural hypothesis, as well as an implicit assumption often encountered in cultural psychology: that cultural constructs remain stable over long periods of time. Chapter 4 uses a laboratory based method to test overlap between two constructs discussed in Chapter 2: personality

and mode of thought. The first laboratory based test of the ecocultural hypothesis to date is presented in Chapter 5, which uses a priming paradigm to test if cognitive mode can be shifted as the hypothesis predicts. Novel primes are used for this test, namely two economic games: the public goods game and the multi-armed bandit. The first part of Chapter 6 investigates how well cultural variation in the public goods game models the real life public goods situation of tax system. Further parallels are drawn between the public goods game and the tax system in terms of Hofstede's cultural dimensions. A hypothesis based on this finding is formed, which is experimentally tested in the second part of Chapter 6. Chapter 7 concludes by drawing together results across chapters and indicating how findings support a group of interconnected cultural constructs found in Chapter 2. Finally, future directions are presented, in which findings in this thesis may help to develop internally coherent evolutionary theories of culturally variable cognitive traits.

CHAPTER 2: PATTERNS IN CULTURALLY VARIABLE COGNITION

2.1 ABSTRACT

The first part of this chapter reviews the most researched dimensions that have been proposed to capture cross-cultural variation in human cognition and behaviour – analytic/holistic cognition, tightness/looseness of norm following, Hofstede's multi-dimensional model, and variation in personality, as well as one not often considered by cultural psychologists: economic behaviour in the public goods game. The focus is not so much on in-depth analyses of these dimensions but rather on qualitative connections between them. The second part of the chapter discusses some recent hypotheses for the origin of culturally variable cognition. In order to develop good evolutionary hypotheses, I argue that we need a wider view of the whole of human culture, with emphasis on temporal changes, more so than further analysis and differentiating between dimensions.

2.2 INTRODUCTION

Across the globe there is much variability in human psychology. Variability between individuals is readily noticeable: everyone knows someone chattier and someone less chatty than themselves. But variability exists also on a societal level, where people belonging to that society commonly understand the local variant, but not outsiders. For instance in not all societies do people feel it is morally right to make a profit when lending out money, or feel uncomfortable with silence in social situations. Understanding where the variation comes from is of vital importance if we want to understand our evolution; how the human species got to its current state, where it is going next, and more importantly: how we can make sure that the future

state is one where the whole of humanity is at a high and stable level of well-being. For this goal we need to learn the ramifications of changing parts of the system: analogous to how using DDT as insecticide caused detrimental changes in places of the ecosystem that we did not expect,[1] tweaking some parts of culture through social policies and political intervention may, without us realising it, cause unwanted side-effects.

The first stage of inquiry into cultural psychology, that of observing phenomena, has reached maturity and has given us a wealth of global data on a wide range of psychological constructs (Heine & Norenzayan, 2006). However, merely describing the differences between cultures has not led us to answer the questions as to why these differences exist at all (Matsumoto & Yoo, 2006), which is the goal of the second stage of inquiry. For the second stage to proceed we need to first understand which of the hitherto observed constructs overlap, find the most parsimonious way (i.e. using the smallest number of variables) in which the observed cultural differences can be accurately described (Heine & Norenzayan, 2006), and to find the *patterns* in cultural differences; the way different variables interact. Then stage two can be fruitfully advanced through incorporating evolutionary theory derived from biology (Mesoudi, 2011).

The particular branch of evolutionary theory that is appropriate here is "cultural evolution" (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981), which contends that cultural change constitutes a Darwinian evolutionary process that shares fundamental features with genetic evolution (although also differs in key aspects). Consequently, many of the same concepts, tools and methods that evolutionary biologists use to study genetic evolution can, and have, been used to

[1] Rachel Carson – Silent Spring, 1962

improve understanding of cultural change and diversity (Mesoudi, 2011). For many aspects of cultural evolution great advances are already being made, for example in material culture (arrow heads, Mesoudi & O'Brien, 2008; textile weaving; Tehrani, Collard, & Shennan, 2010); languages (Atkinson, Meade, Venditti, Greenhill, & Pagel, 2008); social organisation (Currie, Greenhill, Gray, Hasegawa, & Mace, 2010); and cultural practices such as consuming milk (Holden & Mace, 1997). Cultural evolutionary theory seems ideally suited to contribute to the second "explanatory" stage of cultural psychology, given that evolutionary theory is geared to answering "why" questions: why did a particular trait (genetic or cultural) emerge, why did it spread, and how can past selective and non-selective forces explain current distributions of traits (genetic or cultural)?

Cultural psychology, however, seems to be lagging behind in this goal of explaining, as well as describing, patterns of behaviour, as have other branches of psychology (van de Vijver & Leung, 2000). Possibly this is because the subject matter of psychology – internal cognition – is relatively intangible. Whereas material culture leaves artifacts (e.g. arrowheads), and even language often leaves written records, cognition does not generally leave traces and therefore is more difficult to reconstruct in hindsight. Furthermore, the nature of the between-society variation of psychological traits is not the same as that of the more tangible aspects of culture. Knowledge of tool use and language for example are acquired skills: they require a learning period and variants are not likely to spontaneously emerge in the individual. Conversely, in general people will naturally have access to different variants of cultural psychological traits but learn that some variants are socially more acceptable than others. This distinction makes the boundaries of cultural psychological traits much less clear than for cultural artifacts, complicating the study of their evolution.

The common method of quantifying psychological traits is through approximation via questionnaires with Likert-scales, which has been a successful approach. However, for comparing traits between societies this method has been criticised because people compare themselves to different outsiders whilst filling out their questionnaire (the reference group effect; Heine, Lehman, Peng, & Greenholtz, 2002), and because people respond differently to scales (e.g. Chen, Lee, & Stevenson, 1995). Despite its flaws the questionnaire has nevertheless been an invaluable tool to uncover extensive cultural variation (e.g. the World Values Survey, 2006).

Encouragingly, over the last few years there has been a rise of more direct measuring of culturally variable cognition with eye tracking studies (e.g. Goh, et al., 2010) and neuroscience techniques (e.g. Chiao, Harada, et al., 2010; Jenkins, Yang, Goh, Hong, & Park, 2010). Another promising development is the study of proxies for these constructs in the form of cultural artefacts (Lamoreaux & Morling, 2012; Masuda, Gonzalez, Kwan, & Nisbett, 2008), which observe the result of culturally variable cognition displayed in the natural environment instead of the lab. These last methods in particular may provide invaluable data for reconstructing past cultural variation in cognition, and addressing ultimate cultural evolutionary hypotheses.

With the goal in mind of fostering greater integration between the fields of cross-cultural psychology and cultural evolution, the first part of this chapter discusses relationships between some major themes of human cognition, traits and behaviours that vary across the world. The goal is *not* to be exhaustive (there are many reviews on these individual topics) but to see what gaps in the research still exist before we can apply evolutionary theory to culturally variable cognition. For this goal I will include cultural psychology, personality and economic behaviour. I

feel justified in taking all these factors into account since synthesis in some form or another is called for by psychologists, biologists and economists alike (Ariely & Norton, 2007; Gintis, 2007; Mesoudi, Whiten, & Laland, 2006; Wilson, 1998). The second part of this chapter discusses several of the current hypotheses for the emergence of the globally variable cognitions described, and the last part gives recommendations for future research, several of which are pursued in the rest of the thesis.

2.3 LINKS BETWEEN CULTURALLY VARIABLE COGNITIONS, TRAITS AND BEHAVIOURS

Psychologists and other social scientists have been trying to reduce the number of variables found in the huge complex field of cultural constructs (Georgas, van de Vijver, & Berry, 2004). The links between a few cultural dimensions have been indicated before (Triandis, 1989), but the exercise is due renewal. Here I discuss a few prominent culturally divergent constructs, and the links between them.

2.3.1 Analytic and holistic cognition

Numerous studies have shown there are strong differences in perception and thinking styles between Western and East Asian societies (Nisbett & Masuda, 2003; Nisbett, Peng, Choi, & Norenzayan, 2001). People from Western societies preferentially use analytic cognition which includes focusing on categories and elements, while people in East Asian societies use a holistic cognition and are more attentive towards context and relationships. Differences in analytic and holistic mode of thought have been found in many laboratory studies. One example of a laboratory test for cognitive mode is the *rod-and-frame task* (e.g. Witkin & Goodenough, 1977), in which a participant is asked to rotate a rod surrounded by a frame until it is

vertical. The frame is tilted itself, which will lead field-dependent, holistic people to misjudge the angle of the rod, but field-independent, analytic people are not influenced by the surrounding frame. Chinese participants doing this test made more errors than American participants, indicating they were more field-dependent and thus more holistic than the Americans (Ji, Peng, & Nisbett, 2000). Another test which shows distinctions in cognitive mode is the *change blindness task*. Participants are shown two almost identical pictures in sequence the second of which has only a slight difference with the first. In one test (Masuda & Nisbett, 2006) Americans noticed changes in the focal object faster than changes in the background, while East Asians noticed changes in the background faster than Americans. East Asians did not differentiate between changes in focal or background objects. These results indicate that East Asians were more attentive to the context, or more holistic, than were Americans.

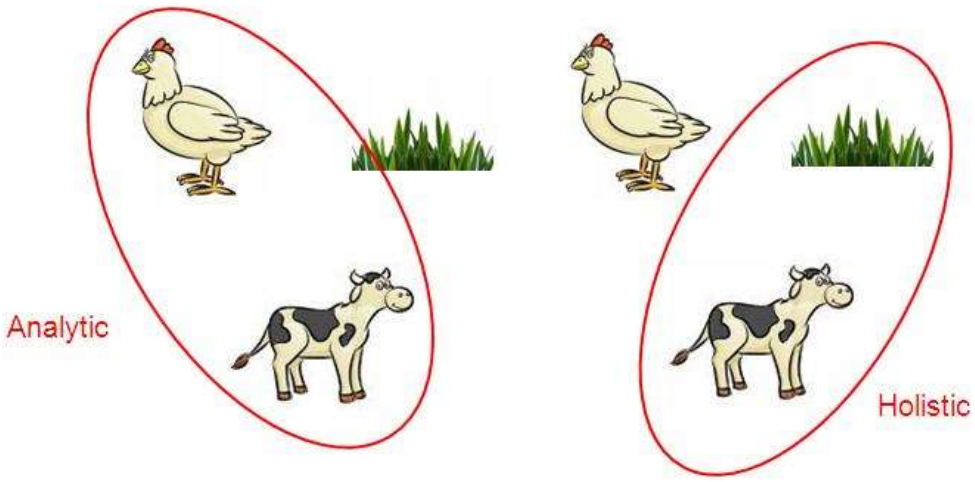

Figure 1: A categorisation task using pictures, to distinguish reasoning styles (Markman & Hutchinson, 1984). Participants are asked: "Which does cow belong with: chicken or grass?". If the answer is chicken, the participant has used taxonomic reasoning by thinking of the category 'animals', which reflects an analytic mind set. The grouping of cow with grass is a thematic choice (cow eats grass) which is a mark of a holistic thought. Based on Ji, Zhang and Nisbett (2004).

Other examples include the *categorisation task* (Figure 1), the *framed-line test* (Kitayama, Duffy, Kawamura, & Larsen, 2003), attention to focal object vs. background in pictures (Chua, Boland, & Nisbett, 2005; Kuwabara & Smith, 2012; Masuda, et al., 2008; Masuda & Nisbett, 2001), detection of co-variation (Ji, et al., 2000) and rule- versus exemplar-based category learning (Norenzayan, Smith, Kim, & Nisbett, 2002).

Thinking styles do not only differ between Western and East Asian participants, but also between other societies. Varnum, Grossmann, Kitayama and Nisbett (2010) review that Russians and Croats are more holistic than Americans, and Germans are more analytic than Russians. Hunter gatherers have been found to be more analytic than farmers (Witkin and Berry, 1975 in Witkin & Goodenough, 1981). Groups within societies can also differ in cognitive style. For instance in one Turkish region herders were found to use a more analytic mode of thought than farmers from the same region (Uskul, Kitayama, & Nisbett, 2008). When comparing Jewish boys from Orthodox or secular backgrounds, the former were found to be more field-dependent than the latter (Dershowitz, 1971 in Nisbett, 2003). These findings indicate that being dependent on the group influences cognitive style and makes one more field-dependent or holistic, while being socially independent goes together with independent cognition in general (Nisbett, 2003).

These findings cannot be taken to mean that all people in these societies are equally holistic or analytic, or that their use of cognitive mode for one thing indicates they will use the same mode for something else. When Na et al. (2010) gave participants a battery of laboratory tests, it was found that individuals showed little between-task agreement. It was also found that one group's mean might be higher than the mean from another group, but this does not mean that each individual from

the first group also scores higher than each individual from the second group (to assume so would be to commit the 'ecological fallacy'). There can be considerable overlap (Na, et al., 2010).

Neither should the societal levels of analytic or holistic mode of thought be taken to mean that people in the same instance consistently use one mode of thought rather than another. In one experiment (Miyamoto, Nisbett, & Masuda, 2006), participants were primed with photographs of New York and Tokyo, after which they were asked to do a change blindness test. Both Americans and East Asians reported more changes in background after seeing New York street scenes than after pictures from Tokyo. The difference between the two cities was the amount of contextual information in the pictures: New York street scenes were less complex and ambiguous than Tokyo street scenes, showing that i) a person's mode of thought is not a stable trait but can be changed, and ii) the environment can prime people towards one mode of thought rather than another (Miyamoto, et al., 2006). Another priming study confirmed this using a method to increase or decrease people's sense of power (Miyamoto & Ji, 2011). Participants were asked to write down a personal event in which they had successfully influenced another person (increased power), or one in which they adjusted to the wishes of another person (decreased power). Participants primed for increased power were found to become more analytic, and participants in the decreased power condition were found to become more holistic (Miyamoto & Ji, 2011). Language has an effect as well. Among bilingual people Ji, Zhang and Nisbett (2004) found that people who think in both languages have access to both cognitive styles: if they are tested in English they are more analytic than if they are tested in Chinese. A prerequisite for this effect is how much both languages are integral to the test subjects' thought process. If a language is too unfamiliar the

person will translate to their mother tongue, bypassing the effect of language (Ji, et al., 2004).

An important factor in individual-level cognitive style is socioeconomic status (SES), which is an indicator for a person's level of education, income, control over resources and subsequent constraints (e.g. Leventhal & Brooks-Gunn, 2000). In subjective psychological terms it is marked by a feeling of power (Miyamoto & Ji, 2011). In a within-society test people with high SES were observed to have an analytic mode of thought (Na, et al., 2010). Miyamoto and Ji (2011) showed that this correlation is mediated by feeling of power. They argue that people who feel powerful have the capacity to disregard irrelevant information, i.e. focus on subject instead of context.

2.3.2 Tightness/looseness

Recently another cultural dimension has been brought back to the forefront of cultural psychology: the dimension of tightness-looseness (Chan, Gelfand, Triandis, & Tzeng, 1996; Gelfand, 2012). This dimension describes how strict societal norms are, and how strongly people are expected to adhere to these norms. In tight societies the rules are clear and there is low tolerance of deviation, for which harsh punishment is incurred, while in loose societies there is either an unclear norm or people are sanctioned less for deviating from the norm (Gelfand, Nishii, & Raver, 2006). These societal differences were first observed in agricultural (farming and herding) societies on the one hand and hunter/gatherer societies on the other hand, where the former were found to be tighter than the latter (Barry, Child, & Bacon,

1959).[2] The presence of tightness in both farming and herding societies was thought to be an effect of the time delay between the daily necessities of caring for the food stock and the eventual yield of that stock, in order to ensure a food supply far into the future. Therefore members of the society should eschew individual innovation, since there was no way of knowing the outcome and risking a famine was too dangerous. On the other hand, hunting and fishing peoples relied solely on the day's work for their food supply on that same day, which means individuals taking initiative did not risk much, and stood the chance of a high reward for their innovation. Indeed, child rearing practices were in line with these expectations across 104 societies with a range of subsistence methods (Barry, et al., 1959).

Recently a large-scale study showed differences in tightness/looseness for 33 countries (Gelfand, et al., 2011). Nearly 7000 participants were asked to respond to a tightness/looseness scale which asked questions on strictness of social norms on a 6 point Likert-scale (ranging from Strongly Disagree to Strongly Agree). Questions were, for example, "There are many social norms that people are supposed to abide by in this country", or "In this country, if someone acts in an inappropriate way, others will strongly disapprove". Participants also rated a set of 12 behaviours (e.g. laugh, kiss, eat) for appropriateness across 15 situations (e.g. classroom, funeral ceremony, public park), and were asked questions such as "to what extent does the situation require that people monitor their own behaviour or 'watch what they do'?". The results gave a scale of countries ranging from Ukraine being the loosest society, and Pakistan the tightest. Western societies scored intermediate on this scale.

[2] Often the work of Pelto (1968) is cited as the forebear of contemporary research into tightness/looseness, but definitions of what marks a tight or loose society are markedly different. Pelto's criteria were concrete, e.g. communal ownership of economic resources, central rule, taxation, theocracy, etc. He wrote that criteria like "deviant behaviour is easily tolerated" were too vague.

Investigating their 33 country scores on this dimension for a range of historical and ecological factors (controlling for GNP[3]), Gelfand et al. (2011) found positive correlations between tightness and population densities in 1500 and 2000, territorial threat from their neighbours during the period 1918–2001, historical prevalence of pathogens, contemporary food deprivation, lower protein supply, more natural disasters, and higher infant and child mortality. Also found were positive correlations between tightness and autocratic rule that suppresses dissent, less open media, fewer political rights and civil liberties, more police per capita, and less crime. As expected based on conceptual unrelatedness, there was no statistical relationship with GNP.

Even though in general we may expect some within-country similarities because of shared institutions, politics, language and shared narratives (Hofstede, 2001), again we find some within-country differences. When comparing two cities in the USA, Protestant-founded traditional Boston and Spanish-settled progressive San Francisco, it was found that Bostonians scored significantly higher in tightness than San Franciscans (Plaut, Markus, Treadway, & Fu, 2012).

One factor that has been suggested as a cause for tightness/looseness is homogeneity or heterogeneity of the population (Triandis, 1989). Compare for instance Japan which is tight, with Thailand which is loose. Japan is an island, isolating it from other areas and thus having a homogenous population. Because of the homogeneity inhabitants may expect each other to know and understand the rules and abide by them, resulting in tightness. On the other hand Thailand lies in an area that feels the pull between major cultures India and China. Therefore people from Thailand have had to learn to tolerate different people with different ideas, making it

[3] GDP (Gross Domestic Product) is roughly the total value added by all residents in the country. GNP (Gross National Product, renamed GNI) is roughly the total value added by all residents of the country plus that of nationals abroad. (http://data.worldbank.org/indicator)

a heterogeneous and thus loose society. The differences between tight Boston and loose San Francisco support this idea: San Francisco has a much higher immigrant population than Boston does, which makes San Francisco less homogenous and less tight than Boston (Plaut, et al., 2012).

Tightness/looseness and analytic/holistic cognition

There is no clear conceptual relationship between tightness/looseness and the analytic/holistic mode of thought discussed in the previous section. Gelfand et al. (2006) discuss the pioneering works of Berry (1966; 1967) among others, who found that children in societies with strict discipline were more field-dependent (holistic) than children in societies with loose child-rearing practices. However, it is not specifically discussed how work on field-(in)dependence relates to tightness/looseness. These constructs seem conceptually unrelated.

2.3.3 Hofstede's multi-dimensional model

The two previous sections described dimensions that aimed to account for *some* human cultural variation in cognition and behaviour, but there have been several efforts to encapsulate *all* human cognitive and behavioural variation in just a few dimensions. One of the most influential attempts is Hofstede's model (Hofstede, 2001; Hofstede, Hofstede, & Minkov, 2010). A social psychologist working in the field of organisational studies and management, Hofstede based his model on approximately 90,000 questionnaires from respondents at all job levels of IBM, a global technology and consulting business. This data from over 70 countries led Hofstede to originally distinguish 4 dimensions: individualism/collectivism (IDV), uncertainty avoidance (UAI), power distance (PD) and masculinity (Mas). Later additions were long-term orientation (LTO) and indulgence versus restraint (IVR)

(Hofstede, et al., 2010), which have not yet been much used in the literature and shall therefore not be discussed here.

Of these dimensions, IDV has been by far the most researched (Taras, Kirkman, & Steel, 2010). Hofstede defined it as follows: "Individualism stands for a society in which the ties between individuals are loose: Everyone is expected to look after him/herself and her/his immediate family only. Collectivism stands for a society in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty." (Hofstede, 2001; p. 225). This can be rephrased as a focus on the self in individualism, versus a focus on the group in collectivism (Berry, Poortinga, Segall, & Dasen, 2002). The group in question can be family, where collectivists are more likely for instance to live with and take care of elderly parents than individualists, but it can also be country or the organisation where one works. In individualistic countries people move companies more easily than in collectivistic countries, and are hired to a greater extent based on previous performance. In collectivistic countries it is more important how many years of education one has and also who one knows: business is done with people who one has a personal bond with, and is less based on contracts. People in individualistic societies also do not shy away from confrontational arguments and speak their mind relatively freely, while in collectivistic cultures people would rather maintain harmony by not disagreeing with each other, and *save face* by being seen to honour their social responsibilities (for a meta-analysis on IDV, see Oyserman, Coon, & Kemmelmeier, 2002).

IDV has been most inspiring to researchers, and in comparison the other three dimensions have been neglected. This is a problem because UAI, PD and Mas

also explain a great deal of cultural variation (Lamoreaux & Morling, 2012; Taras, et al., 2010) and there have been calls for more attention to these dimensions (Kirkman, Lowe, & Gibson, 2006; Tsui, Nifadkar, & Yi Ou, 2007).

UAI, the second dimension, describes "The extent to which the members of a culture feel threatened by uncertain or unknown situations" (Hofstede, 2001, pp. 161). People in countries with high UAI experience greater anxiety when not knowing what a situation entails, or when not knowing the future, than people in countries with low UAI. This explains the greater need for rules, rituals and moralism which are social constructs that negate these anxieties. High UAI is also paired with a stronger belief in absolute truth, and a lower tolerance for breaking the rules. UAI should not be confused with risk avoidance, since one might be faced with a risky situation that is still very clear and not ambiguous.

The third dimension, PD, has to do with sensitivity to authority: "The extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally" (Hofstede, 2001, pp. 98). In countries with high PD there are large gaps between ranks in the hierarchy, with large differences in power, wealth and privileges. Another more descriptive definition is: "The power distance between a boss B and a subordinate S in a hierarchy is the difference between the extent to which B can determine the behaviour of S and the extent to which S can determine the behaviour of B." (Mulder, 1977 in Hofstede, 2001 p 83). One aspect of PD should not be confused with UAI: in high UAI countries people respect the rules, while in high PD countries people respect the boss.

The fourth dimension is Mas, with extremes Masculinity and Femininity. A masculine society is one where "emotional gender roles are clearly distinct: men are

supposed to be assertive, tough, and focused on material success, whereas women are supposed to be more modest, tender, and concerned with the quality of life. A society is called feminine when emotional gender roles overlap: both men and women are supposed to be modest, tender, and concerned with the quality of life." (Hofstede, et al., 2010, pp. 140). The Mas dimension is also expressed in valuing assertiveness and excellence over modesty and not bragging (through being average). In the Netherlands several sayings illustrate the extreme Femininity of the country: "don't stick your head out above the mowing plane", "high trees catch a lot of wind", or "just be normal, that's crazy enough", meaning those who stick out get cut off. One is not supposed to strive for excellence or high status, because this is seen as arrogant. People vote for the underdog in talent shows, and for the politician who looks like "a normal guy".

Hofstede's model has been much criticised (e.g. Ailon, 2008; Kitayama, 2002; McSweeney, 2002; for an early review of reviews, see Søndergaard, 1994) but overall has been largely validated and proven useful (Jones, 2007; Kirkman, et al., 2006; Taras, et al., 2010). There are other models using different dimensions of culture, also based on questionnaires, for example those of Schwartz (1994) and Inglehart (Inglehart, 1997; Inglehart & Baker, 2000). Inglehart's model should be highlighted since he investigated change through time in his dimensions, and therefore is important. Using data from the World Values Survey for 65 societies, Inglehart found two major dimensions: *traditional vs. secular-rational* and *survival vs. self*-expression (Inglehart & Baker, 2000). The first dimension is characterised by such items as: "Respondent has a strong sense of national pride", and "God is very important in respondent's life". People scoring high on these questions are *traditional*, people scoring low are *secular-rational*. The second dimension has items

like: “Respondent has not signed and would not sign a petition”, and “Respondent gives priority to economic and physical security over self-expression and quality of life”. People scoring high on these questions emphasise *survival*, and low-scorers emphasise *self-expression*. Inglehart (1971) found that societies can change in some respects and that economic growth and GNP have a large influence on these changes. Nevertheless, countries are bound by their past, and the amount and direction of change are influenced by history (Inglehart, 1997). Five world-regions (with flexible boundaries) were distinguished based on these factors: Protestant, Roman Catholic, Orthodox, Confucian and Communist, and sometimes Islamic is added.

Although Inglehart’s model has given interesting insights into the role of economy on cultural values, the two dimensions seem to be very broad and not specific. Furthermore Hofstede’s model has been pervasive throughout social research, for example in personality studies (van Hemert, van de Vijver, Poortinga, & Georgas, 2002), health psychology (Rudmin, Ferrada-Noli, & Skolbekken, 2003), business studies (Morris, Davis, & Allene, 1994), advertising (Han & Shavitt, 1994), group creativity (Goncalo & Staw, 2006) and happiness research (Rego & Cunha, 2009). It also has data for the largest number of countries; therefore I have used Hofstede’s model throughout the rest of the thesis.

As also found in the previously discussed constructs of analytic/holistic cognitive mode and tightness/looseness, the level of IDV is not an immovably stable trait. People can be primed for IDV, for instance with the *pronoun-circling* task (Gardner, Gabriel, & Lee, 1999). In this task participants are asked to read a piece of text and circle all pronouns (I, he, we, etc.). Two versions of the same text are used, one with only singular pronouns, and one with only plural pronouns. Participants given the first text are afterwards more individualistic, while participants given the

plural pronoun text become more collectivistic (for a meta-analysis, see Oyserman & Lee, 2008).

Further evidence comes from migration studies. Families who have migrated to another country take over their host country's values slowly over time: after a few generations there are no discernible differences between migrants and the local population (Heine, 2008). As commonly found among Asian people, Japanese people living in Japan score very low on self-esteem, much lower than Westerners. Asian people who have just moved to Canada score higher than Japanese living in Japan. Second generation Asian-Canadians score a little higher, and third generation people score as high as European-Canadians (Heine & Lehman, 2004). There is also a developmentally sensitive time for learning culture (Minoura, 1992). Japanese children who moved to the US before the age of 9 felt American, those who moved between the ages of 9 and 15 felt both Japanese and American, and those who moved after 15 always felt Japanese. Among Chinese who immigrated to Canada a similar effect of age was found (Cheung, Chudek, & Heine, 2011): if immigration took place before the age of 14.5, participants felt they identified with Canadian culture much more than if they had immigrated at an older age.

Both the priming and migration studies show that a person's cultural style is most likely not entirely genetically encoded (though genetic differences may contribute, see section 2.4.3) but mostly formed through a developmental period. Furthermore, people will be continuously primed for the country's level of IDV through the physical products one encounters in daily life, such as magazine adverts (Han & Shavitt, 1994) or school textbooks (Imada, 2012). Indeed, cultural dimensions can be detected more strongly in cultural artefacts than in participant responses in laboratory tasks (Lamoreaux & Morling, 2012; Morling & Lamoreaux,

2008). There is also the possibility that a country's GDP, if it results in money being easily available leads to higher IDV because the mere mention of money primes people for independence (Vohs, Mead, & Goode, 2006).

As Inglehart (1971) already noted, economy has a large influence on culture. Recently these findings have been updated (Tang & Koveos, 2008). It was found that GDP has curvilinear relationships with IDV and PD, where IDV is high for low GDP countries, then decreases at intermediate GDP, and then increases again to high values at high GDP. The inverse is true for PD. This is thought to be due to effects of income inequality, ecological patterns and savings within the country. These dimensions change over time for a country: as GDP for a country goes up, the culture's sense of group vs. individual, and strictness of hierarchy change too. UAI and Mas however do not have strong relationships with GDP but rather with more stable features of society (Tang & Koveos, 2008). The importance of IDV for GDP is concurred in other reports: looking at Hofstede's and Schwartz' model, and relevant items of the WVS, it was found that IDV and dimensions closely related to IDV have a positive effect on GDP (Gorodnichenko & Roland, 2011). This IDV-centred cluster consists of Hofstede's PD; Schwartz' affective and intellectual autonomy, egalitarianism, and to a lesser extent embeddedness; and WVS' 'trust' and 'tolerance' items, which are all correlated with IDV, and none of these dimensions have as robust an effect as IDV does. The only dimension that has an effect but is not related to IDV is UAI, which has an enhancing effect when combined with IDV (Gorodnichenko & Roland, 2011). On an individual-level it was found that people with higher SES also have increased IDV and Mas, and decreased UAI and PD (Steel & Taras, 2010).

Correlations within the model

Worldwide, PD correlates negatively with IDV (Hofstede, 2001), meaning individualistic countries are mostly egalitarian, while collectivistic countries are more likely to have despotic rule. This may be a consequence of measuring modern societies since Aborigines were thought to have a high PD *and* high IDV (Hofstede, et al., 2010). In Western countries UAI correlates positively with PD (people in authoritarian countries do not tolerate ambiguity very well), but this is not the case in the rest of the world (but Aborigines were thought to also have high UAI, with high PD) (Hofstede, et al., 2010).

IDV and analytic/holistic cognition

Some researchers have assumed that analytic and holistic modes of thought are similar to individualism and collectivism (Morling & Lamoreaux, 2008), although until recently Nisbett and colleagues steered clear from this link (Nisbett, et al., 2001). They did repeatedly argue that analytic and holistic modes were closely related to self-construal (Nisbett, 2003; Nisbett & Masuda, 2003; Nisbett, et al., 2001), which in the West is independent, meaning people view themselves as separate from the group, whereas in East Asia self-construal is interdependent, meaning people see themselves as part of the group (Markus & Kitayama, 1991). Priming experiments showed the possibility of this connection: priming for self-construal influenced analytic/holistic mode of thought (Kühnen, Hannover, & Schubert, 2001; Kühnen & Oyserman, 2002), and also individualism/collectivism (Gardner, et al., 1999). Recently this link has been made explicitly (Ishii, 2013), arguing that analytic and holistic modes of thought, and individualism and

collectivism both stem from independent and interdependent self-construal which promotes low-contextual vs. high contextual communication styles.[4]

IDV and tightness/looseness

A connecting factor between IDV and tightness/looseness might be conformity. Tightness has been considered to be very closely related or even identical to conformity as measured with Asch's line judgement task (Berry, 1967). However, Gelfand et al. (2006) argue conformity is an *outcome* of tightness, and is not the same construct. Conformity has been shown to correlate negatively with individualism (Bond & Smith, 1996), but tightness is only *moderately* negatively (but significantly) correlated to individualism and therefore both constructs are argued to be distinct dimensions (Gelfand, et al., 2011 supporting material). Triandis makes the argument on conceptual grounds: "collectivism = common fate, limited resources that must be divided in order to survive; tightness = cultural homogeneity, isolation from external cultural influences" (Triandis, 1989, p 511), though both definitions include structural elements of society that have not definitively been proven to be related to the terms. Tightness also shows a moderately positive significant correlation with PD but no relation to UAI or Mas (Gelfand, et al., 2011 supporting material).

The link between tightness/looseness and IDV might also be made via self-construal. Through subjective content analysis of academic texts on 16 cultures (e.g. Hokkien Taiwan, Lozi, Kurds and highland Scots), focusing on tightness/looseness, collectivism and self-construal, Carpenter (2000) found a strong positive correlation between collectivism and interdependent self-construal, a weak just-significant

[4] Note then when investigating self-construal and cognitive style on an individual level, no correlation between the two was found (Na, et al., 2010).

correlation between tightness and collectivism, and a trend in tightness and interdependent self-construal. Because of the subjective nature of her approach we cannot put too much confidence in these correlations, but they do show that IDV, self-construal and tightness might be part of a loosely interconnected whole.

Arguably the most logical relationship that tightness/looseness has on other cultural dimensions is that variation around the norm within a society will be smaller in tight cultures and larger in loose cultures. For this reason, Taras et al. (2010) found significantly stronger effects of Hofstede's cultural value dimensions on behavioural outcomes in tighter rather than looser countries, where larger effect sizes indicate less individual deviation from the mean.

2.3.4 Personality differences

The next factor that I will describe is that of personality. Although not traditionally considered a cultural dimension, personality has been shown to vary across cultures (see below). Understanding personality in a cultural context is also important because of the on-going discussion as to what extent groups of people make culture, or culture makes people (Church, 2010). Most scholars ascribe a stronger impact of culture on individual behaviour than vice versa, and consider culture to be not just the mean of characteristics of its individuals (Terracciano, et al., 2005). From the field of economic games we already know that group behaviour is not always just a scaling up of individual behaviour. When groups are competing with each other, group decisions tend to be more selfish and less trusting than when individuals are competing (Wildschut & Insko, 2007). Group composition in terms of personalities also plays an important role in the type of group decisions (e.g. Gächter & Christian, 2005). The question of how micro-level social processes link to macro-level social processes is one that should be investigated (Mesoudi, 2009).

Personality is defined as a set of *dispositional traits*: relatively consistent tendencies and temperaments that are biologically based, and are variations within the range of *evolved universal human nature*. A person with a certain personality in a certain culture will then develop *characteristic adaptations* to the cultural environment to navigate life and social relations (Church, 2010).

The set of dispositional traits measured in the Five Factor Model has been the most successful way of studying personality and has led to a plethora of data. The Big Five for short, consists of the factors Extraversion, Conscientiousness, Openness to experience, Neuroticism and Agreeableness (McCrae & Costa, 1987). A much used free alternative is the International Personality Item Pool (Goldberg, et al., 2006), which is equivalent to the original test (Gow, Whiteman, Pattie, & Deary, 2005; Lim & Ployhart, 2006; Mõttus, Pullmann, & Allik, 2006). Extraversion stands for how much attention from others one likes to attract (sample statement: "I am the life of the party"). Conscientiousness is the level of organisation and attention to detail one puts forth ("I am always prepared"). Intellect/Imagination (called Openness to experience in the Big Five test) is curiosity or the level of complexity one likes ("I have a rich vocabulary"). Emotional Stability (called Neuroticism in the Big Five test) indicates how prone one is to negative moods and emotions ("I get stressed out easily"), and finally, Agreeableness means how much one is willing to accommodate others ("I sympathize with others' feelings").

These factors are usually measured by self-questionnaire, which may be criticised for leading to biases if people tend to see themselves as socially preferable personality types. Other criticism includes that it is based on questionnaires which suffer from reference-group effects, meaning people fill out the questionnaires while comparing themselves to different others (Heine, et al., 2002), or that personality

factors developed in Western countries do not translate to factors in other parts of the world (Markus & Kitayama, 1991; Triandis & Suh, 2002).

However, the internal structure of the model holds up when questionnaires from 26 countries are compared (McCrae, 2001), indicating that people's personalities are indeed accurately described by the Big Five dimensions. Further evidence comes from questionnaires filled out for other people, which results in the same structure as when questionnaires are filled out for the self (McCrae, Terracciano, & 78 members of the Personality Profiles of Cultures Project, 2005b). Twin studies have shown that personality is approximately 40–60% heritable, suggesting that a large part of variation in personality is the result of developmental and life history effects. The Big Five model has also been found to result in parallel sex-differences across cultures, with women on average scoring higher on Agreeableness and Neuroticism then men (Costa, Terracciano, & McCrae, 2001) and similar age differences where people's Conscientiousness increases, Neuroticism and Extraversion decreases, and sometimes Agreeableness increases with age across different cultures (McCrae, et al., 2000), regardless of cohort differences in history and situation.

Personality and cultural dimensions

As already mentioned, mean scores for personality have been found to differ across societies (Schmitt, Allik, McCrae, & Benet-Martínez, 2007). In a large-scale study involving almost 18,000 individuals from 56 countries – and 78 researchers – it was found that people from the main world regions scored significantly different from one another. For instance, Asians scored exceptionally low on Extraversion and South Americans scored somewhat lower than other regions. People from Africa scored high and from East Asia low on both Agreeableness and Conscientiousness.

For Neuroticism it is the other way around, where Africans scored very low and East Asians very high. For Openness to experience East Asia and Africa scored very low while South America scored higher than others.

These measures correlate to country-level scores for Hofstede's cultural model. Hofstede and McCrae (2004) found that IDV correlates positively with Extraversion; PD correlates negatively with Extraversion and Openness to experience, and positively with Conscientiousness; Mas correlates positively with Openness and Neuroticism, and negatively with Agreeableness; and UAI correlates positively with neuroticism and negatively with Agreeableness (Hofstede & McCrae, 2004).

There is also a link between SES and personality. Though not often investigated for its own sake, many health and life-outcome studies control for either SES or personality when investigating the other factor (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007), which indicates a likely relationship between the factors. One study that expressly reported relations found that in the upper quartile of SES personality measures showed relatively high ratings for Conscientiousness, and in decreasing order of magnitude Extraversion, Openness, Neuroticism, to the lowest, Agreeableness, and approximately the reverse is found for the lower quartile of SES, i.e. highest scores on Neuroticism, then Agreeableness, Extraversion, Openness and last, low Conscientiousness (Chapman, Fiscella, Kawachi, & Duberstein, 2010). The same main relationship between high Neuroticism and low SES was found in another study, where SES was measured in three factors: occupational status, education and income (Jokela & Keltikangas-Järvinen, 2011). The common pattern seems to be that low SES often occurs together with negative affect (Keltner, Gruenfeld, & Anderson, 2003).

There are alternative models of personality, for example Cloninger's 4 dimensions of temperament and 3 dimensions of character which do not differ much from the Big Five model (De Fruyt, Van De Wiele, & Van Heeringen, 2000). More recently a six-factor model (HEXACO) was developed which is based on adjectives describing characteristics of personality in 7 different languages (Ashton, et al., 2004). This model has the same factors for Extraversion, Conscientiousness, and Openness as does the Big Five model, but differs in how traits of pro-social behaviour are factored. Both models have advantages: the Cloninger model may be more useful than the Big Five model for doing comparative psychology research, and the HEXACO model may be better for understanding language effects on cultural differences in personality composition, but since most research is done with the Big Five questionnaires and both models show striking similarities to the Big Five model, I have used this model in this thesis.

2.3.5 Public Goods Game variation

Although usually not considered by cross-cultural psychologists, another form of culturally variable behaviour is found in economic experiments which aim to measure people's propensity for cooperation. A staple of these experiments is the Public Goods Game (PGG), which is devised to recreate the circumstances of a group which collectively owns a commodity (e.g. Fehr & Fischbacher, 2004). In order to make maximum use of the commodity the group members have to individually practice restraint so as not to exhaust it and give it time to replenish after each use. The group is then at the risk of being duped by members who over-use the commodity for their own benefits. In the experiment a small group of people are given individual endowments. Each participant decides whether or not to put some or all of their endowment into a group-owned pot. The experimenter multiplies

what is in the pot by a certain factor and divides the results among all players, irrespective of their contributions. Players therefore receive both their equal share of the group pot, as well as whatever portion (if any) of the individual endowment that they chose not to put into the group pot (Fehr & Fischbacher, 2004).

Through mathematical analysis using the Nash equilibrium (Nash, 1950) it is found that the dominant strategy should be to contribute *nothing*, since if everyone plays this strategy no player should unilaterally change their own strategy (Hardin, 1971). Therefore keeping the endowment for oneself is the safest option, *plus* one has the chance to receive additional money from the pot. By that logic no rational person should contribute, thus the pot should remain empty and no one should increase their initial endowment. However, this is not the Pareto-optimal strategy, which would be for everyone to contribute since that would mean each individual earns more than if all participants play the safe strategy (Hardin, 1971).

In real life both of these outcomes of group behaviour can be found. For instance environmental problems could be seen as instances of PGGs played rationally: individuals avoid the short term cost of responsibly disposing their waste or investing in green energy, which leads to the pollution and exhaustion of our environment for which the whole population will pay the price (Hardin, 1968; Milinski, Semmann, Krambeck, & Marotzke, 2006). In other real life situations people have found ways to counteract the individual temptations and work collectively towards a greater benefit for all (Ostrom, Walker, & Gardner, 1992). The question of why in some cases humans overcome the free-rider problem and in other cases they do not, has been extensively researched in the laboratory.

Generally it is found that participants start off contributing between 40 and 60% of their endowment (Chaudhuri, 2011; Ledyard, 1995). This is not according to

either mathematically predicted strategy but most likely due to some norm or expectation derived from the framing of the experiment or the social norms the players have learned in real life (Binmore & Shaked, 2010; Henrich, et al., 2005). In repeated games cooperation gradually breaks down until eventually 90% of the participants fail to contribute (Ledyard, 1995). Break down of cooperation can be staved off with varying success and duration through different additions to the game: e.g. communication, (Bochet, Page, & Putterman, 2006), reputation building(Milinski, Semmann, & Krambeck, 2002), and group norm establishment (Baum, Paciotti, Richerson, Lubell, & McElreath, 2012; Chaudhuri, Graziano, & Maitra, 2006). Playing against new people every round (Keser & Van Winden, 2000) and pure anonymity where people do not see each other both result in less cooperation (Bohnet & Frey, 1999; Lamba & Mace, 2010). Interestingly, when players know they will play a long game of 60 or 40 rounds, the decline of cooperation *slows down* so that the start and end points are similar to when players know the game will last 10 rounds, yet the absolute amount that is withheld per round is less (Isaac, Walker, & Williams, 1994). This suggests players do strategise in some way.

Often punishment is offered as a solution to the free-riding problem in the PGG (Ostrom, et al., 1992; Yamagishi, 1986). In a PGG with punishment each player sees individualised but anonymous data on how much contribution each group member made after the group pot is distributed. Then they can choose to pay some of their money (in the form of monetary units used in the game) towards punishing one or more of their group members. The amount punishers put in is multiplied by a certain amount before it is subtracted from the punishee's account (Fehr & Gächter,

2000, 2002). Usually this leads to high and stable levels of cooperation (Balliet, Mulder, & Van Lange, 2011).[5]

It is important to note that when the PGG is expanded with punishment, the game is qualitatively changed and a new Nash equilibrium is now to fully contribute to the public pot (Binmore & Shaked, 2010). The same goes for including rewards for cooperating (Milinski & Rockenbach, 2012): the monetary incentives in the game are changed and the rational solutions change with it. In these cases participants in the laboratory still only have one factor to maximise: money. However, when other elements are introduced to the PGG, like communication for example, there are two factors to maximise: money and social relations. Usually a psychological term is used to explain this effect, such as social norms, or morality, inequity aversion, or the "warm glow" of giving (see Chaudhuri, 2011). In fact, it might be more in line with economic game theory and evolutionary biology to see it as the choice to maximise social relations, instead of money. Maximising social relations makes biological sense: social relations are at the heart of our species (Richerson & Boyd, 1999), more so than in other gregarious primate species (Tomasello, 2010). In fact, chimpanzees seem not to maximise social relations at all, only seeking benefit to themselves in terms of food items (Jensen, Call, & Tomasello, 2007). Of course the

[5] The role of punishment in the evolution of the human-typical strong, wide-spread cooperation is still hotly debated (Hilbe & Traulsen, 2012; e.g. Powers, Taylor, & Bryson, 2012; Rand, Armao Iv, Nakamaru, & Ohtsuki, 2010; for a review see Sigmund, 2007). It is usually thought that punishment must have evolved in order for widespread cooperation to exist. However, the idea that cooperation cannot evolve in a world of selfish individuals comes from analytical models, where often researchers who do not include structure (space or social networks) in their models find that individuals who cooperate or punish suffer detrimental fitness consequences, thus leaving the world full of free-riders. Importantly, researchers who do include space find that cooperation can evolve (Boerlijst & Hogeweg, 1991; Nowak & Highfield, 2011). In a social network model, Rand, Arbesman and Christakis (2011) show that if groups are held constant or are shuffled at random cooperation breaks down, but if individuals get to choose who to work with (reconnecting in the network) cooperation remains high. Effectively this leads to creating *loners*, individuals who do not contribute to or receive anything from the pot (Brandt, Hauert, & Sigmund, 2006; Fowler, 2005). In real life it might be more cost-effective to punish by exclusion rather than punish at a cost, and indeed it has been found that hunter/gatherers do not punish much, they just switch partners (Baumard, 2010). Laboratory PGG experiments show that free-riders may lead to people exiting the group (Yamagishi, 1988). The threat of exclusion from the group (Cinyabuguma, Page, & Putterman, 2006) or even negative feedback (Masclet, Noussair, Tucker, & Villeval, 2003) leads low contributors to increase their contributions. These findings suggest the possibility that the evolution of cooperation is not completely dependent on costly punishment, and at least part of it could evolve through punishment by social exclusion.

PGG in the laboratory is not the same as it is in real life where we see constant evidence of contributions to public goods (Ostrom, 2000). Indeed, if we understand that in real life it is not only money being maximised but other things that are important to different people (comfort, health, social relations, time) we can see why the game is again different, and again analysis would predict different strategies.

PGG and cultural dimensions

As already mentioned, behaviour in the PGG may be influenced by the cultural background of the participants, particularly when participants have no previous experience of the PGG (Binmore & Shaked, 2010; Henrich, et al., 2005). When dividing up 16 subject pools into Inglehart and Baker's (2000) 6 cultural regions, Gächter, Herrmann and Thöni (2010) found significant differences in contributions in the PGG without punishment (Figure 2). Without punishment, all contributions decline, except for those in Athens, and in Arabic speaking cities Muscat and Riyadh. The pattern holds up when punishment is introduced: contributions rise significantly higher than in the non-punishment condition, yet no increase is observed in Muscat and Riyadh, Athens and also Istanbul (the latter two are both in the southern European cultural region). The authors offer no explanation for where these differences come from, but merely note that they exist.

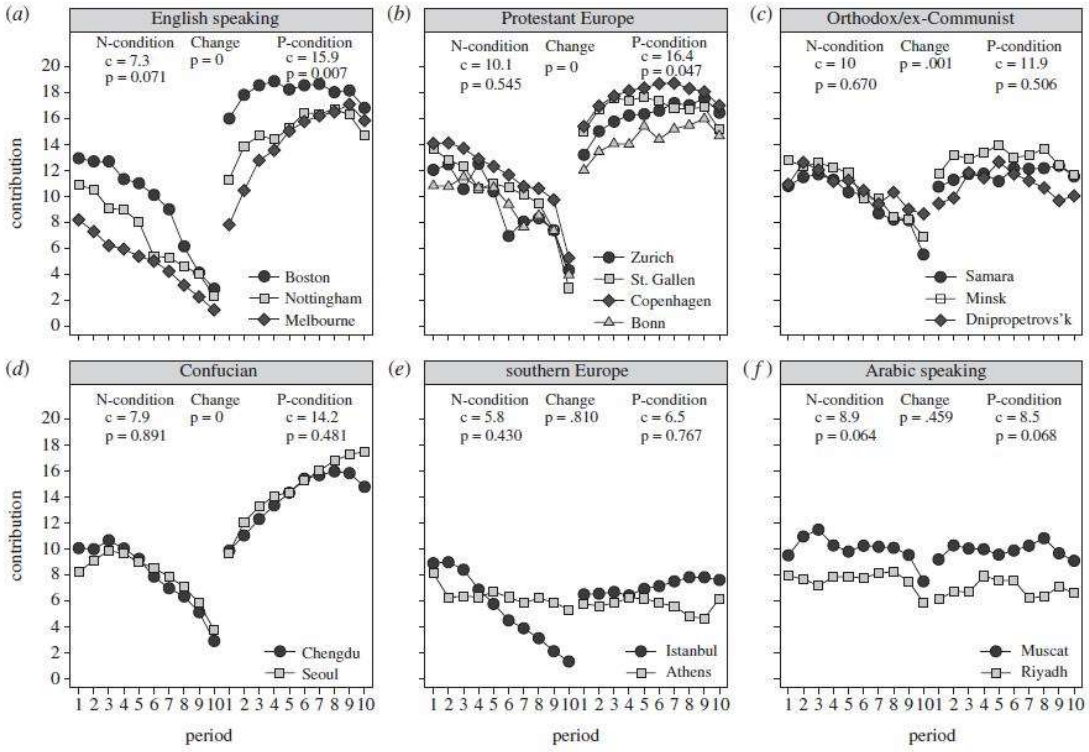

Figure 2: Cross-cultural differences in contributions in the PGG without (N-condition) and with (P-condition) punishment. Cultural regions are Inglehart & Baker's (2000) regions. From: (Gächter, et al., 2010)

Further cultural differences in the PGG have also been found with other countries. Participants from Colombia contributed on average a little more than participants from Vietnam, but both countries showed equal numbers of conditional co-operators (see below), and fewer free-riders than in Western societies (Martinsson, Pham-Khanh, & Villegas-Palacio, 2013). British participants contributed significantly more than Italian participants (Finocchiaro Castro, 2008). Comparing people from the US and Czech Republic it was found that Czechs contribute significantly more to the pot than Americans do (Anderson, DiTraglia, & Gerlach, 2011). Another finding was that Russians contributed significantly less than Swiss people, punished more (including anti-social punishment, which is the punishing of people who contribute, Cinyabuguma, et al., 2006) and expected to be

punished more (Gächter & Herrmann, 2009). This finding was verified for a large Russian participant pool including young and old participants (Gächter & Herrmann, 2011). In this PGG, average contributions to the pot were slightly lower than was found in earlier studies. Interestingly, including punishment did not increase contributions, because next to punishing of free-riders participants also substantially engaged in anti-social punishment, older participants more so than young ones (Gächter & Herrmann, 2011). Again, these differences might not only exist between, but also within societies. Within the city of Cape Town, South Africa, large differences in contribution and punishment behaviours were found between students from white and black secondary schools, and the level of punishment was strongly related to the level of trust (Kocher, Martinsson, & Visser, 2012).

As already briefly mentioned, one interesting behaviour that varies cross-culturally is anti-social punishment, which is the punishing of people who behave cooperatively (Cinyabuguma, et al., 2006; Nikiforakis, 2008). Usually these are low-contributors retaliating against high-contributors who have punished them earlier in the game. This seems to have a detrimental effect: groups with more anti-social punishment consequently contributed less to the group pot, leading to lower profits for the players. In a large-scale study, anti-social punishment was found to vary strongly across societies, more so than punishment of free-riding (Herrmann, Thöni, & Gächter, 2008). It was also found that anti-social punishment, but not punishment of free-riders, correlated negatively to IDV, Mas, GDP, Trust (totals of WVS questions such as “most people can be trusted”), and Civic Duty (total of WVS questions such as “cheating on taxes if you have a chance”). Anti-social punishment increased with PD and UAI (Herrmann, et al., 2008, supporting material).

Behaviour in the PGG has not only been investigated in modern societies but also in small-scale ones such as the pastoralist Orma and the crop farming Machiguenga (e.g. Henrich, et al., 2005). In a one-round set-up it was found that in five out of six small-scale societies individuals contributed much more than expected, while students in Michigan mostly did not contribute (as is usually the case in large-scale societies, Henrich, et al., 2005). A recent study of the fishing and reindeer-herding peoples in Kamchatka, Russia, found extraordinarily high contributions: 97% of endowments was contributed to the public pot (Gerkey, 2013). In the only large-scale *within* society study to date, namely of 16 villages of one Central Indian peoples, it was found that variation in contributions was just as large as previously found between societies, and was mostly dependent on demography (Lamba & Mace, 2011).

PGG and personality

Despite groups mostly behaving in predictable patterns varying with game set-up, participants preferentially use individually differing strategies while playing the PGG (Kurzban & Houser, 2005). The strategies most often observed are cooperation (fully contributing), defection (free-riding) and conditional cooperation: contributing approximately as much as group members or a little less. By far the majority of people play the conditional cooperation strategy (Fischbacher, Gächter, & Fehr, 2001; Isaac, et al., 1994). Participants choose to do this both in hypothetical cases and in actual games where they can earn money (Chaudhuri, 2011). The group composition of people who play these different strategies has a strong impact on the outcome of the game (Gächter & Christian, 2005): when a group has no free-riders full cooperation can be sustained even without any additions to the PGG (Kurzban & Houser, 2005).

With people consistently choosing the same strategy it would make sense that their personalities are also consistent. Indeed some effects of personality have been found. For instance, high Machiavellian people consistently contribute slightly less than their group members, and earn more than low Machiavellian people (Czibor & Bereczkei, 2012). Machiavellian people are characterised by being rational, self-interested and manipulative, and their game play is argued to be led by a strong monitoring of other's play behaviour in the group. This concurs with the finding that people who are high self-monitoring are more likely to be conditional co-operators than people who are low self-monitors (Kurzban & Houser, 2001), as has been found for the same game with only two people (Boone, De Brabander, & van Witteloostuijn, 1999).

In terms of the Five Factor Model, it would be reasonable to expect that people high in Agreeableness and Extraversion would be high co-operators, while Neurotic people would be low co-operators (Kurzban & Houser, 2001). Since high Machiavellian people score low on Agreeableness and Conscientiousness (Paulhus & Williams, 2002) we could also expect these correlations. In one repeated measures experiment it was found that participants who (mostly) played the conditional cooperation strategy, scored significantly higher in Agreeableness than participants who (mostly) played the free-riding strategy. There were no differences for any of the other personality dimensions. Furthermore, participant's preference for a strategy was stable over a time period of 5 months (Volk, Thöni, & Ruigrok, 2011, 2012).

Hilbig, Zettler, & Heydasch (2012) showed that the personality factors Honesty-Humility and – to a lesser extent – Agreeableness correlate positively with contributions. These two factors are part of the personality model HEXACO (see section 2.3.4) and the two factors are together comparative to Agreeableness in the

Five Factor model by McCrae and Costa (1987). Moreover, these participants were high contributors in both punishment and non-punishment conditions. A picture is starting to emerge that Agreeableness, or the propensity to accommodate rather than antagonise, is a strong predictor for contributions in the PGG.

A small number of studies have investigated personality differences when it comes to punishment behaviour. In a study using a hypothetical scenario based on a PGG, it was found that participants' Agreeableness correlated negatively with anger towards the transgressor, a desire to punish, a desire for a high penalty and the willingness to pay a fee for punishment of the transgressor. Other personality dimensions correlated with only one or two of these factors, and people with low Agreeableness had the strongest motivation to punish (Roberts, Vakirtzis, Kristjansdottir, & Havlicek, 2013).[6]

2.3.6 Conclusion: Relationships between dimensions and gaps

Here I have reviewed some major domains in culturally variable cognition, traits and behaviour, and explored links between these domains. Some factors seem to cluster together, such as high IDV, low PD, high analytic cognitive mode, and looseness of norm following (connected through independent self-construal). Interesting connections to this cluster might also be high GDP, high SES and low anti-social punishment in the PGG. Another interesting group of factors surrounds high Agreeableness, which may be a fruitful avenue for further research. These factors are high contributions and low punishment in the PGG, and low UAI and Mas. These clusters may be interesting starting points for investigating the possibility of synthesis among dimensions. A summary can be found in Table 1.

[6] Though this is an interesting finding, note that the internal consistency of the personality questionnaire's Cronbach α's were very low (between .11 and .67). Considering both the inconsistency of the very short questionnaire (2 questions per item) and the set-up of the experiment using a cover story instead of a real PGG, this study is worth repeating with improvements.

Table 1: Links between culturally diverging human cognitions, traits and behaviours.

		Analytic /Holistic cognition	Tightness /Looseness	Hofstede's model	PGG		Economy
					Contribution	(Anti-social) punishment	
Big Five Personality		Unstudied	Unstudied, but possibly via conformity and conscientious-ness	+IDV+Extraversion +PD+Conscientiousness +PD-Extraversion +PD-Openness +Mas+Openness +Mas+Neuroticism +Mas-Agreeableness +UAI+Neuroticism +UAI-Agreeableness	+Agreeableness+ Contributions	+Agreeableness -Punishment Unstudied for anti-social punishment	+Neuroticism-SES In general: +Negative affect-SES
Analytic / Holistic cognition		---	No conceptual relation	Most likely related via (in)dependent self-construal: +Analytic+IDV	Unstudied	Unstudied	+SES+Analytic
Tightness /Looseness			---	+Tightness+PD +Tightness-IDV (Possibly via self-construal) No relation Tightness and UAI or Mas	Unstudied	Unstudied	No conceptual nor statistical relation Tightness and GDP
Hofstede's model				---	Unstudied But possibly vis Inglehart regions	No correlations between Hofstede's model and punishment +Antisocial punishment -IDV, Mas +PD, UAI	+GDP: IDV first drops, then rises PD first rises, then drops No relation GDP and UAI or Mas +SES–PD +SES+IDV +SES+Mas +SES-UAI
PGG	Contribution				---	---	Unstudied
	(Anti-social) Punishment					---	+Antisocial punishment-GDP

2.4 THEORIES FOR THE EVOLUTION OF CULTURALLY VARIABLE COGNITION

In this section I will discuss several hypotheses for the evolution of some of the described cultural dimensions. It is not in itself very remarkable that differences between human societies do exist, since other species have differences between populations as well; chimpanzees (van de Waal & Whiten, 2012), goats (Briefer & McElligott, 2012), etc. Traits in any large group consisting of evolving parts – which do not move around too much – would be expected to eventually end up showing localised differences just by chance, comparable to genetic diversity as a result of isolation-by-distance (Novembre, et al., 2008; Rosenberg, et al., 2005). However, the cultural variation documented in the previous sections appears to exhibit at least some degree of structure and systematic patterning, beyond that expected purely by chance. In this section I discuss three hypotheses that have been proposed for the origin of cultural differences: the ecocultural hypothesis, the parasite-threat hypothesis and the ecological variability hypothesis. First I will describe the different processes which may play a part in the evolution of culture. Findings are discussed in the concluding section.

2.4.1 Possible explanations for cultural differences

Cultural differences between human societies could be underpinned by several processes: they may be caused by genetic differences between populations, they may be evoked by the environment in which that society lives, they may be the result of cultural transmission and evolution, or they may result from a mix of one or more of these processes.

Genetic basis for cultural differences

One argument for genes being the basis for cultural differences might be that genes for culturally diverging traits have been found. For instance, there is a polymorphic region of the serotonin transporter gene, 5-HTTLPR, that has a short (S) or a long (L) allele version that is linked to elements of negative affect (e.g. Caspi, et al., 2003; Gonda, et al., 2006; Munafo, Brown, & Hariri, 2009; Sen, Burmeister, & Ghosh, 2004). Carriers of the L allele have been found to focus on positive affective information and selectively ignore negative information, while S carriers tend to focus on the negative information (Fox, Ridgewell, & Ashwin, 2009). The distribution of these alleles has been found to vary across the world: there are more S allele carriers in East Asia than in Western countries (Gelernter, Kranzler, & Cubells, 1997; Nakamura, et al., 1997), giving rise to a field of research investigating the connection between this gene and others, and cultural constructs such as individualism and collectivism (Chiao, Hariri, et al., 2010; Way & Lieberman, 2010).

However, despite genetic differences between cultures, studies on immigration show that people can adjust given enough time, or crucially, the right timing. As discussed in section 2.3.3, three generations are enough for families to assimilate into the host culture (Heine & Lehman, 2004). The period of developmental sensitivity for learning culture is also evidence against a genetic basis for cultural differences: children can adjust well to their host culture if they immigrated before the age of 15, and even better if they immigrated before the age of 9 (Cheung, et al., 2011; Minoura, 1992).

Environment + individual learning

Cultural differences could also be individual responses to the environment or ecology that a person finds themselves in. The assumption is that an individual learns appropriate behaviour through association, which will vary under different conditions. No distinction between non-social and social learning is made (Mesoudi, 2011). The learning responses to which individuals have access are assumed to be encoded genetically, and different environmental conditions evoke different genetically encoded responses. Individuals share phenotypic plasticity that has itself evolved genetically. Cultural differences then arise because of different environments, which shape the population's phenotypic responses in different ways (Tooby & Cosmides, 1992). Tooby and Cosmides use the analogy of a jukebox to illustrate this idea of 'evoked culture'. Imagine several identical jukeboxes each playing a different song in response to different 'environmental' inputs (the different people who chose different songs). Each jukebox is theoretically capable of playing any song in its repertoire (analogous to an individual's genetic repertoire of all possible behaviours), but variation is generated because of different environmental inputs triggering different pre-encoded inputs.

Even if we ignore the complex question of what constitutes the 'environment' in modern societies – ecology, SES, the technosphere – at a minimum this hypothesis predicts that small-scale populations that live in close connection to their ecology are predicted to exhibit these varying phenotypic responses to different environmental conditions. As it happens, they do not: even within the same environment, two populations can develop completely different cultural traits (Hewlett, De Silvestri, & Guglielmino, 2002), while populations that live in completely different environments can have similar cultures, such as Brits and

Australians. Individual learning in response to environmental conditions cannot be the only explanation to differing cultures (Mesoudi, 2011) although they may play a role (Nettle, 2009).

Cultural evolution

Like genomes, culture evolves: it has the prerequisites of variation, selection and inheritance (Mesoudi, Whiten, & Laland, 2004). Cultural evolution can be studied through understanding the micro-level processes of cultural transmission (who copies what from whom), mutation (how novel traits emerge) and selection (why certain traits are favoured over other traits) and connecting these micro-level processes to macro-level patterns in time and space (Mesoudi, 2011). For example, the pathway that transmission takes is important for the speed of change for the cultural trait. Vertical transmission (from parent to offspring) will lead to slow changes, if any, while horizontal transmission (learning from others of the same generation) can lead to fads and fashions (Cavalli-Sforza & Feldman, 1981). Also the cognitive biases humans display when learning information can shape cultural evolution. For instance, people copy traits and behaviours of prestigious individuals more readily than of others (Henrich & Gil-White, 2001), as is evident in advertising using celebrities (Stallen, et al., 2010). Besides a bias for *who* to learn from, there can also be a bias for *what* to learn: people transmit social information like gossip more easily than non-social information, e.g. the spread of fire in a dry environment (Mesoudi, Whiten, & Dunbar, 2006). Cultural transmission biases such as these are often studied under controlled conditions in the lab, allowing researchers to precisely measure and quantify those biases (e.g. Caldwell & Millen, 2008; Kempe, Lycett, & Mesoudi, 2012).

Macroevolutionary patterns are studied by adapting evolutionary methods from biology and adjusting them for cultural studies. For instance, phylogenetic methods that biologists use to study speciation, in cultural studies can be used to reconstruct the evolution of cultural artefacts, languages and behavioural practices. For instance, using phylogenetic analysis it was found that it is much more likely for a cattle-keeping society to be patrilineal than matrilineal, indicating a connection between the two traits (Holden & Mace, 2003). Other studies have used phylogenetic methods to reconstruct the evolutionary histories of languages (Pagel, 2009) and projectile technology (O'Brien, Darwent, & Lyman, 2001).

Gene-culture co-evolution

In a mix of some of the above, gene-culture coevolution, or dual inheritance theory, posits that human genes and cultures both influence each other. Natural selection may lead to different cultures emerging in different ecosystems; conversely, culture may modify or generate selection pressures on genes, and thus drive genetic evolution (Laland & Brown, 2002).

The most famous result of the field is that of the co-evolution of dairy farming and lactose tolerance, where it was found that the cultural trait of rearing cattle for dairy emerged first, which then gave rise to the spread of the human gene for digesting lactose second, not the other way around as was previously thought (Holden & Mace, 1997). Recently a large number of genes that have recently undergone rapid evolution have been implicated for gene-culture co-evolution (Laland, Odling-Smee, & Myles, 2010). Among the functions of these genes are alcohol metabolism, pathogen response, hot or cold tolerance, and brain function and development.

Although it is not always necessary to strictly adhere to one or another of these schools of thought on the potential origins of cultural variation, it is useful in understanding implicit assumptions when thinking about the evolution of culturally variable cognitions.

2.4.2 The ecocultural hypothesis

The ecocultural hypothesis concerns the question of how Western and East Asian cultures came to differ in analytic and holistic modes of thinking. The hypothesis states that contemporary modes of thought have their origin in social systems in culturally ancestral societies reinforcing independence of the self from others (ancient Greece) or interdependence of the self with others (ancient China; Nisbett, 2003). Specifically, ancient China had fertile grounds which favoured agriculture. This requires people to be sedentary and form strong bonds within their community, especially where concerted farming was necessary. Additionally, parts of China needed collectively maintained irrigation systems which were under centralised rule. These factors led Chinese people to focus on the group and relationships: a holistic mode of thought. The mountains of ancient Greece, on the other hand, did not lend themselves to agriculture, so hunting, herding, fishing and trade[7] were the means of acquiring subsistence. No strong cooperation was required for these activities, leading the Greeks to focus on separate objects and categories: an analytic cognition. The analytic and holistic modes of thought then persisted throughout the ages from ancient Greece to contemporary Western societies and from ancient China to contemporary East Asian societies. Besides these reasons Nisbett also states that it might not necessesarily be ecology that determines cognition, but that in fact modern entrepreneurship might well give rise to an

[7] "(and -let's be frank- piracy)" (Nisbett, 2003, p.34)

analytic mode, while a close-knit religious community would foster holism. Other types of work that require people to be independent should also should lead to analyticism, as evidenced by hunter-gatherers and people in industrial societies who indeed are more analytical than farming peoples (Nisbett, 2003, p. 43). In fact, Nisbett writes, towards the end of the Middle Ages, farming activities in Europe increased which arguably may have made people more holistic until about the 15th century when trade brought on a renewed age of individualism (Nisbett, 2003).[8]

This hypothesis is a descendent of an earlier hypothesis regarding cognitive styles, in which analyticism and holism are called field-independent and field-dependent cognition, respectively (e.g. Witkin & Goodenough, 1977, 1981). Witkin and Goodenough (1981) argued that farming societies would have stronger conformity, and would therefore be more field dependent (holistic), because "stress on conformity discourages the development of separate autonomous functioning" (pp. 89). Their argument was based on the observation that in general hunter/gatherers were nomadic, consumed their food immediately, had loose societal rules,[9] relatively few social roles, and little centralised authority. For farmers it was observed that they were sedentary, had tight rules, many social roles and centralized authority, because there was a vital need to regulate people's food intake to ensure there was enough food left between harvest seasons. Therefore the child-rearing practices in hunter/gatherer societies were focused on autonomy and self-reliance, while those in farming societies were focused on obedience and compliance. Many studies found the same for subsistence societies (Berry, 1966; Berry, 1967). Much

[8] Recently Varnum, Grossmann, Kitayama, & Nisbett (2010) have argued against inheritance of cognitive styles from Aristotle or Confucius, but since this is one single paper among many we continue to investigate the ecocultural hypothesis.

[9] Witkin & Goodenough (1981) make an explicit link to Pelto's (1968) study, and incorporate tightness/looseness into their theory: sedentary farming → tightness → conformity → field-dependence. Contemporary scientist Michele Gelfand who works on tightness/looseness mentions field-(in)dependence in only one paper without making explicitly clear how she sees the relation (Gelfand, et al., 2006), and does not discuss analyticism/holism anywhere else, to the best of my knowledge.

evidence was also found for the link between societal style and cognitive style: hunter/gatherers were found to have a field-independent (analytic) style, while agricultural groups were found to have a field-dependent (holistic) style (Witkin & Goodenough, 1981). More supporting evidence comes from a contemporary study: in one region in Turkey it was found that solitary working herders were more analytic (field-independent) than cooperatively working farmers and fishermen (Uskul, et al., 2008).

The hypotheses developed for subsistence peoples were not meant for modern societies, even though many instances in modern societies had been found where there was a link between societal pressure to conform and field-dependency or holism (e.g. between Mexican and American children, Mexican-American and Anglo-American adults, or Israeli Jews of Middle-Eastern or Western heritage). However, unlike Nisbett (2003), Witkin and Goodenough (1981) made especially clear that they thought in modern societies the driving factor is the *recent* level of conformity, and not the ancestral niche in the ecosystem. They also note that "A common finding in [non-subsistence level groups] is that the experience of education is related to field independence, particularly as manifested in cognitive restructuring skills. … We have another indication here that particular training experiences may contribute to the development of field independence" (Witkin & Goodenough, 1981, footnote 6, p. 96). It is clear that in the cognitive mode of modern societies, Witkin and colleagues ascribed a large role to child-rearing practices.

Therefore, it seems that Nisbett's major contribution to the theory was the idea that cognitive style developed while a society was still subsistence based, and then transmitted intact through the ages until the present modern society. This can probably be seen as a mix of evoked culture and cultural evolution (see Section

2.4.1), where initial differences arise as responses to subsistence or social structure, and are then transmitted down generations via cultural transmission. It is slightly unclear what Nisbett sees as the method of transmission, but most probably he would assign it to cultural systems of thought; Confucianism in East Asia and Greek philosophy in Europe (and consequently the Americas and Australia). The assumption then is that the transmission of cognitive style for over 2000 years has been relatively stable, with continuity of cognitive style from ancient Greece and ancient China to the present day West and East respectively. However, the assumption of continuity has not been tested, while if it were to be disproven it would have great consequences for our understanding of human cultural variability. As such it is due for rigorous investigation.

2.4.3 The pathogen-stress hypothesis

Recently a new theory for the evolution of individualism and collectivism has been proposed, based on pathogen-stress (Fincher & Thornhill, 2012; Murray, Schaller, & Suedfeld, 2013; Thornhill, Fincher, & Aran, 2009). Proponents of this hypothesis argue that the propensity of humans to avoid pathogens leads to in-group assortative sociality. This includes strong emphasis on bonds with (extended) family and commitment to a religion, while avoiding members of the out-group (xenophobia) who may harbour novel pathogens to which one does not have immunity. When investigating 98 countries for pathogen load (Fincher, Thornhill, Murray, & Schaller, 2008), it was found the prevalence of 9 different pathogens (leishmanias, trypanosomes, malaria, schistosomes, filariae, leprosy, dengue, typhus and tuberculosis) correlated negatively with individualism and positively with collectivism. The historical prevalence of these pathogens showed the same pattern (except for tuberculosis for which there was no historical data, therefore the authors

substituted with contemporary data). Because the correlation also exists with historical pathogen prevalence, it is concluded that past pathogen threat has selected for a more in-group focused, out-group shy cultural style: collectivism. The authors suspect that humans have evolved a developmental plasticity for the level of individualism or collectivism which is cued by the pathogen load encountered in the environment (Fincher, et al., 2008). This would therefore be an example of evoked culture (see Section 2.4.1).

Chiao and Blizinsky (2010) propose a genetic basis for the link between pathogen-threat and individualism/collectivism: that of the serotonin transporter gene (5-HTTLPR) introduced in section 2.4.1. The authors' hypothesis is that the S allele for the gene and collectivism co-evolved in response to increased pathogen-threat. A positive relationship was found between S-allele prevalence and collectivism (but none of the other dimensions from Hofstede's model), but these two factors correlate negatively with anxiety and mood disorders as reported by the World Health Organisation. The authors conclude that collectivism must be an 'anti-psychopathy' buffer against the negative effects of the S-allele. This can be seen as a case of gene-culture coevolution (see Section 2.4.1), with the cultural trait of collectivism responding to genetic variation in serotonin transporter function.

The pathogen prevalence hypothesis is based on the well-researched behavioural immune system, for which there exists strong evidence in both humans (e.g. Park, Faulkner, & Schaller, 2003) and other species (e.g. Evans, et al., 2006). The behavioural immune system is an evolved adaptive mechanism to avoid disease from pathogens, consisting of the emotion of disgust and management behaviour or hygiene (reviewed in Schaller & Park, 2011). In humans it is old (Curtis, 2007) and universal (Curtis, Aunger, & Rabie, 2004; Curtis, de Barra, & Aunger, 2011).

Nevertheless, there are differences between individuals: participants scoring high on Extraversion and Openness to experience scored low on germ aversion (Duncan, Schaller, & Park, 2009), and societies that historically have had low levels of the 9 pathogens described above also had higher mean levels of Extraversion and Openness (Schaller & Murray, 2008).

Priming experiments have shown that being cued for pathogens activates the behavioural immune system, and results in avoidance behaviour of others that seem anomalous, including people who are disabled, obese, elderly or even foreign (reviewed in Schaller & Park, 2011). When people's immune system is temporarily suppressed, their ethnocentric and xenophobic attitudes increase, also temporarily. These findings suggest that the behavioural immune system is flexible, and not static.

Therefore for a social structure which allows individuals to interact with in-group members and exclude out-group members to evolve *primarily due* to parasite stress, this would have to be based on the priming effects, and on not being able to discern in a stranger anomalies that are just because of the unfamiliarity of the face, or anomalies because of illness. This could have led to a collectivist social system that was passed down through the generations, and while still in a pathogen rich environment, it would retain its adaptive function. However, if at some point there are no longer cues of parasites in the daily environments of people – because of improved health care, infrastructure, or hygiene regulation – given the demonstrated flexibility of the behavioural immune system, collectivism could potentially switch to individualism. If cultures do change over time, then is should be made explicitly clear over which period in history the historical pathogen load is measured, since that

would be of vital importance to the hypothesis. To the best of my knowledge a time period is not reported in the papers (Fincher, et al., 2008; Murray & Schaller, 2010).

If change over time is possible (which is the case if indeed humans have developmental plasticity for individualism or collectivism cued by pathogen load in the environment, Fincher, et al., 2008), then that environment in contemporary Western countries would be one of high GDP, and thus good health care and hygienic environment. The unique effect of GDP on collectivism that was found in addition to the unique effect of parasite stress (Fincher, et al., 2008) should then be given more weight than it is at the moment. The cognitive mechanism would be easy to account for: people in high GDP countries do not have to be so fearful of infections, and thus of out-group members, because they know that if they get ill, the high quality medical care in their country can probably cure them.

Furthermore, the causality of the relationships is not established, and could be in the opposite direction of what proponents of the theory suggest. Recently it was found that social stress in female macaques influenced gene expression of their immune system (Tung, et al., 2012). When the hierarchy of the macaques was experimentally manipulated, it was found that their immune system response predicted with 80% accuracy what their rank in the test group was. This means that social stress may cause increased susceptibility to pathogens, while it was traditionally thought to be the other way around – that disease-prone individuals would end up low in the hierarchy (Tung, et al., 2012). For the pathogen-hypothesis theory this could imply that a strong focus on the group, humility and service - or for that matter a strict (as opposed to flexible) social hierarchy in which there are many subordinates, may have come first (collectivism), and the increased activation of the behavioural immune system followed.

2.4.4 Cultural adaptations to environmental variability

The last hypothesis I will discuss here is based on ecological differences, combined with cultural evolutionary theory (Chang, et al., 2011). This hypothesis proposes that during the Pleistocene and earlier, in the East African rift valley where humans evolved, genetic evolution drove the development of human cognition. After the migration out of Africa, when humans colonised the globe, cultural evolution started to play a role in matching behaviour to these new environments and cultural differences like the ones we see today emerged.

Human cognition as it evolved early in the history of our species can be described as being in two systems (though this is a shorthand; in reality things are more complex). System 1 is automatic, fast, intuitive and effortless while system 2 is slow, monitoring, controlling and effortful. The first is good for ducking a ball, the second for solving maths equations (Kahneman, 2011). Chang et al. (2011) argue that in stable environments system 1 is selected for, and modules of dedicated intelligence will arise, while in variable environments more plasticity is required which favours system 2 and leads to higher generalised intelligence. The Pleistocene saw increasing climatic variability which had evolutionary consequences for the fauna, and gave rise to the human species (deMenocal, 2004) with system 2 cognitive abilities.

After leaving Africa, the human species spread across the globe, encountering environments that varied in their variability. At low latitudes (close to the equator) the amount of sunlight hitting the Earth's surface is stable throughout the year, but because of the Earth's tilted axis yearly variability in sunlight increases with latitude which causes temperature changes over the year. Therefore, Europe which lies between 36 to 63 degrees latitude has more seasonality, thus a more

variable climate, than China at 18 to 45 degrees. This means that Europe's rainfall and temperature are more variable and have more extremes than in China, but it also has resulted in a higher occurrence of ice and snowstorms, earthquakes, and severe winters.

In highly variable environments it is adaptive to use individual learning, while in stable environments people should use social learning. Because individual learning comes at a cost due to trial and error, social learning in a stable environment will secure the right information to be learned at a lower cost. In a variable environment information learned from others can be outdated because the environment has changed, so a little trial and error might lead to better results (Richerson & Boyd, 2005). This is what happens at the individual level (McElreath, et al., 2005; Mesoudi, 2008) and the group level (Henrich & Boyd, 1998). Therefore, based on their environments alone, Europeans would be expected to have developed preferences for individual learning while Chinese would be expected to prefer social learning.

Chang et al. (2011) demonstrate that variability can be found both in environment and in the realm of social interaction. Politically, China has had a centralised government for much longer than Europe. Migration has been higher in Europe than in China due to ever-changing frontier zones and commercial trade freedom. Both the frequency and duration of warfare has been higher in Europe than in China. Methods of acquiring subsistence also differ between Europe and China: China has more agriculture than Europe, both in percentage of the population and in character (responsibility is shared among the family). Europe on the other hand has more trade and division of labour, and agriculture quickly became a trade as well. Chang et al. (2011) further discuss pathogen load as an environmental factor that can

lead to differing cultures. In stable environments more pathogens are able to survive than in variable environments. Consequently, pathogen load is inversely related to latitude and thus higher in China than in Europe. Pathogen threat from the environment may be an independent drive for social as opposed to individual learning, because trial-and-error entails too much risk of illness or death.

The differences in variability being ubiquitous, the effects have influenced other related areas of cognition as well. Derived from social vs. individual learning, two self-systems have emerged: dependent and independent self-construal. The cultural differences in individual traits and social systems feed back into each other and have co-evolved. Chang et al. (2011) conclude by saying that cultures will continue to be influenced by environmental change versus stability, but that with the onset of global sharing of information cultures will probably become more similar.

2.4.5 Conclusions

All three hypotheses described above are more or less based on the ecological niche human populations inhabited at some point in time. In the ecocultural and the parasite-threat hypotheses timescales are not clearly defined which makes it difficult to establish origins and rates of change, which in the environmental variability hypothesis is better explained, though still not clearly enough. The ecocultural hypothesis is purely based on individual learning in the local environment, and the question of transmission of the learned constructs after leaving the environment is largely neglected. The pathogen threat hypothesis suggests a plastic genetic basis for dealing with an environmental factor, and is unclear about what is meant by 'historical'. Chiao and Blizinsky seem to suggest a genetic basis for collectivism, which is selected for by pathogen stress. The ecological variability hypothesis takes care to explain both the origin and continued cueing of cultural mode in appropriate

time scales, and explicitly mentions a feedback process between individuals and social system, thus avoiding the problem of pre- and post-modern societies.

However, none of the hypotheses involve populations other than those from the West and East Asia. Admittedly, Western cultures have been quite dominant in at least the last few centuries or so, and East Asian cultures are very different from our own, so that this contrast piques interest is to be expected. Nevertheless, African and Arabic societies are also very old and have very interesting features, which could be enormously informative. That psychological studies neglect these populations is understandable given the difficulty of finding experimental subjects. However, when it comes to developing evolutionary theories more care should be taken to account for the whole of the human species, not just a few populations (Henrich, Heine, & Norenzayan, 2010).

Finally, it is noteworthy that the first two hypotheses, developed by Western scientists, analysed and focused on a single cause with a linear process, while the Hong Kong based scientists developed a holistic approach that included feedback between individuals and social systems.

2.5 Points of consideration for moving forward

Discussion of the present work

In this effort I have left some often discussed general limitations in the respective literatures to the end, because they apply to all hypotheses. For instance, the ecological fallacy: the problem of extrapolating from group traits to individual traits. Sometimes constructs correspond between the level of the individual and the group, such as personality in terms of the Big Five and IQ (aggregate properties), but sometimes the whole is greater than the sum of its parts (emergent properties) (Na, et

al., 2010). This problem can be circumvented if we take care to use the appropriate measure at each level of research. For instance, when investigating interactions between nations, using country-level differences suffice (e.g. cultural artefact data). But when we look at national policies we need within-country measures for different bands of SES and other cultural sublevels. For aggregate properties mapping findings from one level to the next could be easy (personalities found in student populations predict means of societies, given intrinsic maturation and SES effects) but for emergent properties this will be more difficult. It might be possible to learn how to take existing data from questionnaires and map findings onto other levels through investigating the emergent effects of interaction patterns on the lower level.

Despite some omissions, I believe the study of the diversity of human cultures benefits from the synthetic approach presented in this chapter. By investigating broad connections between different lines of research we might be able to find the underlying variables and greatly reduce the number of parameters we have to work with when making models of human cultural behaviour. While this approach would not be appropriate for studies at a finer level, for the goal of investigating the species as a whole it is necessary to take a distant vantage point.

Considering cross-cultural psychology

In the first part of this chapter many links were found, though some tentative by being based on conceptual comparison only. Most links have been established through correlational analysis only but since they conceptually also make sense they are worth investigation. The most salient cluster consists of high IDV, low PD, high analytic cognitive mode, and looseness of norm following (connected through independent self-construal), high GDP, high SES and low anti-social punishment in

the PGG. Another interesting group that might be a second cluster is high Agreeableness, high contributions and low punishment in the PGG, and low UAI and Mas.

Often researchers claim that their dimension is different from another dimension, usually on statistical grounds. However, since most dimensions are tested with questionnaires asking different questions, phrased in different ways and tested on different populations, it cannot be ruled out that some questionnaires are tapping into the same underlying construct. It is possible that different pictures have been formed because the object of investigation has been held up to the light in different angles. As discussed in the introduction, there is a need for unity in the social sciences, which includes taking an evolutionary approach. For cultural psychology to enter stage 2 and discover why cultural variation exists in its present state (Heine & Norenzayan, 2006), more robust and rigorous hypothesis building is necessary.

Considering evolutionary hypotheses for human culture

In the second part of this chapter different evolutionary hypotheses for the origin and persistence of cultural variation in cognition were discussed. The common argument was that differing cultures constitute responses to differing ecosystems. One problem is that the question of timescales is not appropriately addressed. How long did it take for humans to develop responses to different ecologies, and how were cultural traits transmitted throughout human history up to the present? How flexible and changeable are cultures? These questions have to be answered if a solid theory for the evolution of cultural differences is to be developed.

The need for investigating temporal change in cultures has been discussed before now (e.g. Oyserman, et al., 2002). Hofstede has been criticised for not investigating change over time (Kirkman, et al., 2006) and where he has, he has

concluded that the observed changes were too small to say a country had changed in any meaningful way (Hofstede, 2001, p. 36). Like other studies on cultural change over time, this study only looked back a few decades or so (Butzer, 2012; Cooper & Denner, 1998; Hamamura, 2012; Inglehart, 1971; Rogler, 2002; Tang & Koveos, 2008; Trzesniewski & Donnellan, 2010). Researchers are rightly wary not to extrapolate into the past from research over a few decades, since the last century has seen modernisation with an unprecedented increase in population size, which has had many consequences. Some work stands out for being more rigorous and informative, for example Inglehart and Baker's (2000) study of change over time (Figure 3) and within-culture differences (Figure 4). By comparing change and within-cultural differences one can get a better overview of the trajectories cultures are taking, and find the non-random manner of change that needs to be explained with evolutionary theory.

Even though we do not know the pace of cultural evolution, we can glean some insight from a few studies. As discussed earlier in this chapter, the developmentally sensitive period for learning culture is before the age of 14.5, and is strongest before the age of 9 (Cheung, et al., 2011; Minoura, 1992). Witkin and colleagues discussed the importance of child-rearing practices and argued that it was important in both pre-modern and modern societies (see section 2.4.2). A study I have not yet discussed shows a relationship between societal economic practices, developmental period and cultural cognitions. Greenfield, Maynard and Childs (2003) tested change over time in a small-scale Zinacantec Maya community in Mexico. A transition in this society's culture was found to have coincided with the transition from a subsistence agriculture-based society in 1969/70, to a money-based commercial society in 1991 and 1993. Before the transition, girls were taught to

weave textiles in a scaffolding way, marked by obedience and a lack of trial-and-error learning. Only four traditional patterns were used in textile weaving. After the transition, girls learned to weave in a more independent way and much more innovation in textile patterns was found (Greenfield, et al., 2003). A picture starts emerging that cultures can change in a generational timeframe. If a population's children at a young age experience different societal, social or cultural demands from what generations before them experienced, they will grow up thinking in a different pattern than the generation before them and their collective influence on their culture could appear as shifted measurements on cultural dimensions.

If this is true and it turns out that cultures indeed are changeable and not static, then the question of what constitutes 'environment' in modern society should be answered. Undoubtedly environment shaped the cultural practices of its first human inhabitants and has been a driving force in the evolution of our cultures. However, if individuals can be primed for culture, then we also have to consider the current life-situation of people, in terms of GDP and SES. GDP predicts and possibly even determines life-expectancy, child-mortality, and the birth rate. SES is important for health and social stress. These are all biologically relevant factors and should be expected to have an influence on human culture.

Conclusions

In this chapter I have argued that we need to know more of the connections between different cultural constructs, in order to reduce the number of parameters. This is necessary if we want to build analytical models of human cultural diversity. Models are useful for testing evolutionary hypotheses, and for predicting welcome and unwelcome changes when manipulating one factor rather than another. This will be important for public policy making in the future. For hypothesising about the

evolution of culture it is necessary to take into account cultural patterns from other world regions than the West and East Asia, to include more cultural dimensions like power distance and uncertainty avoidance, and to study temporal change. Ecology cannot be the sole source for cultural differences but where it is a major factor other factors besides arable land and pathogens should be taken into account. For instance, food crops differ dramatically across world regions, which, if shown to influence the endocrine system could have important consequences for social behaviour and thus culture. These considerations can help advance stage 2 inquiry into cultural psychology.

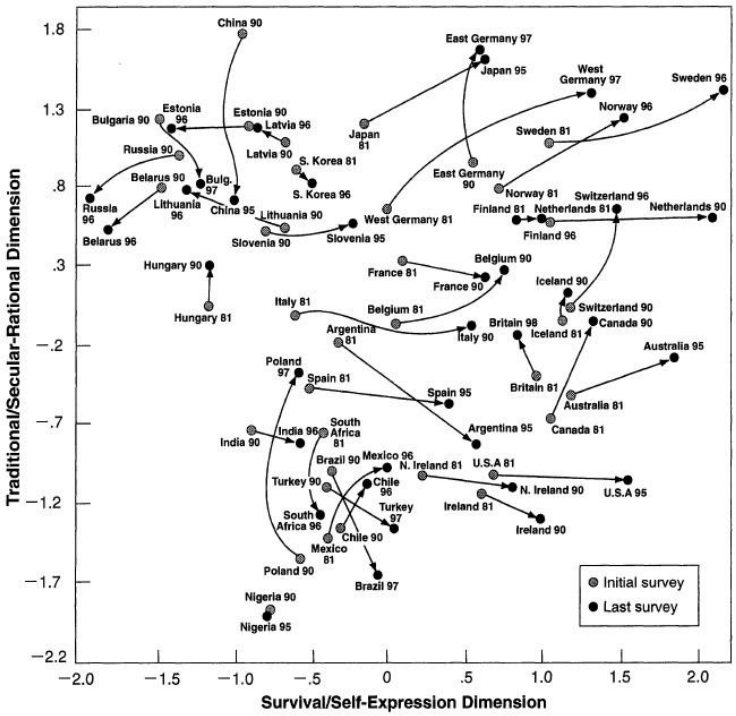

Figure 3: Change over time (1981–98) in Inglehart's (1997) dimensions *traditional/secular-rational* and *survival/self-expression* (see section 2.3.3). From: Inglehart and Baker (2000)

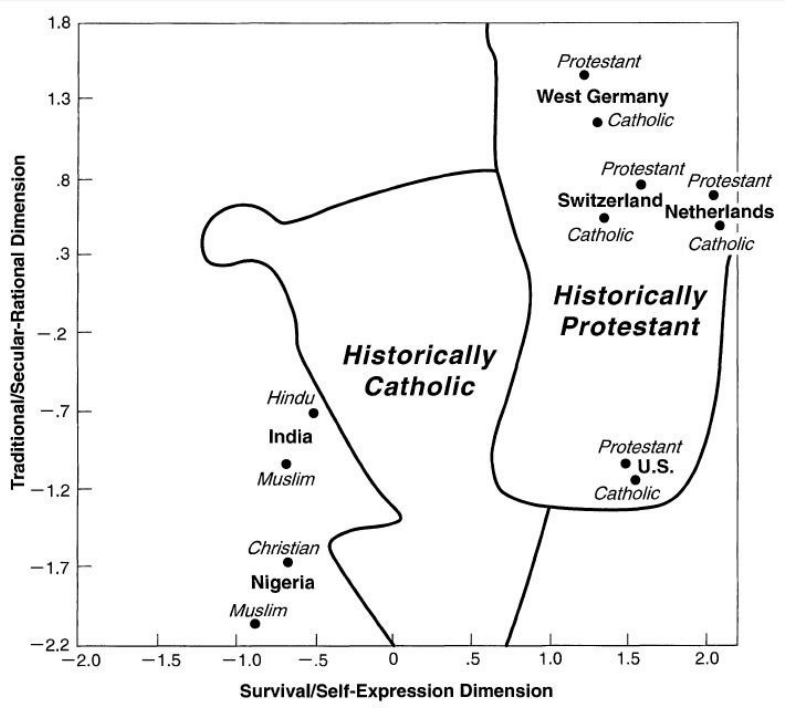

Figure 4: Within-country variation of Inglehart's (1997) dimensions traditional/secular-rational and survival/self-expression (see section 2.3.3).From: Inglehart and Baker (2000)

CHAPTER 3: THE DYNAMIC CULTURAL EVOLUTION OF TWO COGNITIVE STYLES – EVIDENCE FROM ART HISTORY

3.1 ABSTRACT

Previous studies have shown that analytic-holistic cognitive variation may be reflected in art, with analytic cognition favouring a greater emphasis on single, focal individuals in portraits than holistic cognition, and holistic cognition favouring higher horizons and a more global overview in landscape paintings than analytic cognition. Here I use this finding to explore historical change in cognition, by analysing the temporal dynamics of artistic style from the 15th century to the present in the Netherlands, England and Germany. This novel historical method can be used to test hypotheses that analytic-holistic cognitive styles originated in ancient Greece/ancient China respectively (predicting no or little change over the last 600 years), and/or have their origins in herding vs. farming, respectively (predicting an increase in analytic cognition as the proportion of the population in Europe involved in farming has decreased). Variation in painting style can also provide a measure of social norm following (tightness-looseness), which again has been claimed to have been historically constant. Contrary to these hypotheses, I find that paintings indicate these European countries were initially relatively analytic, before dropping to highly holistic styles in the 17th and 18th centuries (comparable to contemporary East Asian paintings), before increasing to present day analytic styles. It is suggested that this drop to holistic levels coincided with particularly intense warfare, tying holistic cognition in Western Europe to threat of violence. In addition, variation in painting

styles appears to have increased over time, indicating a relatively recent origin for looseness in European countries rather than historical constancy.

3.2 INTRODUCTION

Numerous studies have shown systematic cognitive differences between East Asian and Western people, with East Asians typically showing more attention to contextual relations between objects and individuals, i.e. holistic cognition, and Westerners attending more to focal objects or individuals independently of context, i.e. analytic cognition (Goh, et al., 2010; Nisbett & Masuda, 2003; Nisbett, et al., 2001). Much of the research investigating analytic/holistic cognitive styles has been laboratory-based (see section 2.3.1), but recently several studies have shown corresponding differences in external cultural products (Masuda, et al., 2008), which have been found to have larger effect sizes than psychological measures do (Morling & Lamoreaux, 2008).

Analytic/holistic cognitive differences have been found in visual representations as well. Masuda et al. (2008) investigated East Asian and Western visual art collected from museums in these respective areas. Based on previous findings it was expected that portraits originating from analytic cultures would be predisposed to focus on subject and neglect surroundings, while portraits made in holistic cultures were expected to give a large role to surroundings in order to depict the subject in relation to their context. Therefore a prediction was made that in Western portraits the face would take up a larger area of the portrait than East Asian portraits would. The prediction was found to be true: Western portraits devoted more space to a single focal individual (at 15% of the total painting) than East Asian portraits (at 4%). The same pattern was found in a laboratory study asking students to make portrait photographs: Westerners took pictures with larger faces than did

East Asians (10% and 3%, respectively, Masuda, et al., 2008). Facebook profile pictures concurred this finding: Western profile pictures emphasise faces more than Asian profile pictures do (13% and 9%, respectively, Huang & Park, 2012).

Next to portraits, visual art depicting landscapes have also been found to differ along an analytic/holistic divide. Western landscapes were predicted to represent the view one person could have of their surroundings and thus to be painted in perspective. On the other hand, East Asian landscapes were predicted to be painted with a group perspective in mind by taking a bird's eye view and incorporate important elements in the landscape, regardless of whether or not one person could see these elements from one place in the landscape. In paintings with perspective the horizon height will be lower than in paintings from a bird's eye view, so therefore the height of the horizon should be lower in Western paintings than in East Asian art. This was indeed found with paintings collected in museums: East Asian landscapes had higher horizons (at 56% of the total height of the painting) than Western landscapes (at 39%, Masuda, et al., 2008). Laboratory studies where students drew a landscape picture showed the same difference: Westerners drew significantly lower horizons (at 56.37%) than East Asians (at 67.16%).

A related finding is that East Asians include a larger number of items in an image than Westerners, based on their preference for more contextual information (2008). This was not measured in the museum collections but East Asian students in the laboratory did draw significantly more additional items in their landscapes than Western students did (10.72 items vs. 6.19 items, respectively). In cultural studies on web design the same difference has been found, where Chinese websites include more banners, buttons and colours, and less white space than American websites (Lo & Gong, 2005). In addition to the previously mentioned bird's eye view, the

preference for additional objects could be another reason for East Asian images to have high horizons: these leave much room for additional objects in the landscape.

These findings raise the possibility of art as a window into the cognition of people from the past, whose cognition obviously cannot be assessed directly. In this study we use art to measure changes in cognitive style from the 15th century to the present in three Western countries with rich artistic histories: the Netherlands, England and Germany. In these countries large quantities of art from about the 15th century onwards have been well preserved, documented and digitalised and therefore make an ideal proxy for studying temporal changes in cognitive style. While Masuda et al. (2008) compare the means of centuries of Western and East Asian art without regards for when it was made, here we will specifically investigate time series of dated art.

Using this method we will test the ecocultural hypothesis set out in section 2.4.2, which argued that the type of acquiring subsistence typical in ancient China and ancient Greece, farming or herding respectively, led to a type of social relations (interdependent or independent), which led to either holistic cognition in ancient China and its cultural offspring, or analytic cognition in ancient Greece and its descendants (Nisbett, 2003; Nisbett, et al., 2001). Some evidence for the association between farming and herding on the one hand, and analytic and holistic cognition on the other hand, has been found in a contemporary population in Turkey (Uskul, et al., 2008). However, this contemporary link only offers supportive evidence for the origin of analytic/holistic cognition as set out by the eco-cultural hypothesis, not for transmission into contemporary non-herding and non-farming societies.

With regards to Western European countries, two conflicting predictions can be derived from the eco-cultural hypothesis. The first is that Western European

countries inherited their culture directly and unchanged from ancient Greece, and thus have consistently had an analytic mode of cognition throughout time. Therefore all three countries' portraits should show consistently large faces compared to the surface of the portrait, and its landscape art should show consistently low horizons. (Figure 5: Predictions for analyticism and holism in Western Europe, leading up to the present day.) The second prediction is that Western European countries went through a transition from holistic to analytic cognition at some point in the past, since farming has been the main mode of acquiring subsistence in the past, implying a holistic cognitive mode, while contemporary Western European countries have an analytic style (Kitayama, Park, Sevincer, Karasawa, & Uskul, 2009).

It is estimated that by 500 AD Western Europe was populated with settlements of farmers and stock breeders, though animal husbandry was not yet practiced very much. People may have supplemented their diet with occasional hunting but the crops they grew were their primary source of food. Until 1150 Western Europeans were thus partially self-sufficient (direct agricultural consumption), and only traded excess produce. After 1150 there was a marked increase in the amount of products people bought at markets instead of growing it themselves (indirect agricultural consumption) but it is only from about 1850 that the total male working population that worked in agricultural production dropped to less than 50%[10] (Slicher van Bath, 1963). In 2002 the percentage of people working in agriculture in Western Europe was only a few per cent (the Netherlands 3%, United

[10] One could argue that animal husbandry is a form of herding and therefore agriculture cannot be seen as farming. However, animals were a vital part of the farm because of the manure necessary for plant feed, and most farms would have a system where both crops and livestock were present (Slicher van Bath, 1963). Commercially rearing sheep for wool as was common in England may have been more akin to herding or trading (Black, 1997).

Kingdom 1.4%, Germany 2.5%; Gapminder, 2011).[11] In the same year the percentage of workforce in agriculture in China was 44.1%, similar to the number in Western Europe around 1850. If China is holistic because of the prevalence of agricultural workers, then Western Europe up to 1850 should show high levels of holistic cognition as well. Therefore, based on farming as a driving force for holistic cognitive mode, portraits should start out with small faces compared to the frame and face size should increase until the present. Landscapes should start out having high horizons, which should become lower as we near the present (Figure 5).

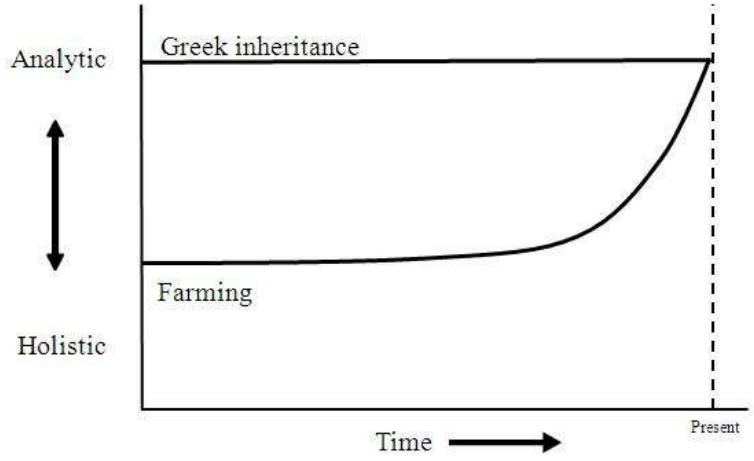

Figure 5: Predictions for analyticism and holism in Western Europe, leading up to the present day.

Our historical dataset can also be used to explore temporal dynamics in another cultural dimension: in how strictly people keep to social norms (Gelfand, 2012, see section 2.3.2). Recently a large study measured tightness/looseness for 33 countries (Gelfand, et al., 2011). Correlating their 33 country scores on this dimension to several historical and ecological factors, Gelfand et al. (2011) then

[11] This number is the percentage of the working population active in agriculture, hunting, forestry and fishing. Separate data for these indicators is to the best of my knowledge not available for all four countries. However, subcategories do not seem to make much difference: of the total number of people working in agriculture, fishing only made up .38% in the UK in 2004, in Germany .65% in 2002, and in the Netherlands 1.57% in 2000 (www.laborsta.ilo.org).

found a positive correlation between tightness and population densities in 1500 and 2000 and territorial threat from their neighbours during the period 1918-2001 (controlled for GNP), all cases in which there is strong dependency on the group.

The underlying assumption in this work is that the level of tightness-looseness in a society is a static trait, as evidenced by the authors' correlating population density of the year 1500 and threat from neighbouring states over the last century to present day questionnaire measurements. The second aim of this study is to test whether the dimension of tightness/looseness is static or dynamic over time, by using the art. Cultural artefacts are found to vary along this dimension, for example in the accuracy of public clocks where tight societies also had a higher percentage of accurate time giving than loose societies (Gelfand et al. 2011, supplement). The same should go for norms in art: people in a culture with tight norm following should produce images that fall within a narrow range of variation. On the other hand artists in a loose society should vary widely around the norm (Gelfand, et al., 2006). According to this principle we use the six datasets of art for the Netherlands, England and Germany, and analyse the range of variation per type of measurement (area of the face compared to the frame, and relative height of the horizon) for each of these time series. If the construct is static, all three countries should show a consistent amount of variation in art throughout time. If the construct is dynamic, we should see significant differences in the amount of variation. Note that our measurement differs markedly from Gelfand et al.'s (2011) measurement, in that Gelfand et al.'s study measured the participants' perceived norms within a country, while our method taps into what people actually do with a norm.

3.3 METHODS

3.3.1 Collection

Portraits and landscapes were selected online from renowned online databases. For Dutch portraits we used Web Gallery of Art (WGA) , the Netherlands Institute for Art History (or Rijksbureau for Kunsthistorisch Documentatie, RKD) , and the top results of the 21st Atelier Competition which was determined by 4000 visitors and an expert jury (CODA) . For Dutch landscapes we used the WGA, the Frans Hals museum (FHM) and the RKD, where also physical databases were consulted. For English portraits we used the National Portrait Gallery (NPG) , and Bridgeman art, culture & history images. For English landscapes we used the NPG, Bridgeman, RKD, WGA and the Royal Academy of Arts (RAA) . For German portraits we used the NPG, Bridgeman, RKD, Bildindex der Kunst und Achitektur, The Museum of Modern Art (MoMa), and Saatchi Gallery (2012) . For German landscapes we used Bridgeman, Bildindex, RKD, WGA and the Metropolitan Museum of Art.

Portraits were selected by searching for the key word ‘portrait’ (or in Dutch ‘portret’, in German ‘Porträt’); and the nationality of each country. Portraits had to show only one person (although a non-descript baby was allowed) and had to be dated to an accuracy of within 5 years. Excluded were miniatures; panels belonging to a larger set; and pieces described as being fashioned after another. Only the first appropriate piece per artist that came up in the database was selected. Roughly 10 paintings per 25 years were gathered. This resulted in 205 Dutch portraits (1430-2010), 197 English portraits (1527-2010) and 227 German portraits (1383-2012).

Landscapes were selected by searching for the respective nationality, and for as much as possible by selecting images marked as being of the genre ‘landscape’.

Images had to show an unobstructed horizon line at least 1/3rd of the width of the painting and had to be dated to an accuracy of within 5 years. Excluded were foreign landscapes including those of the Italianised era, images depicting religious figures in heaven, and pieces described as being fashioned after another. Only the first appropriate piece per artist that came up in the database was selected. Roughly 10 landscapes per 25 years were gathered. This resulted in 208 Dutch landscapes (1435-2011), 190 English landscapes (1434-2008) and 231 German landscapes (1410-2012).

Four of the time series start at about the same time, between 1410 and 1435, but English portraits start only in 1527 while German portraits start a little earlier in 1383. The differences in starts of the time series are an unavoidable artefact of this study because we are restricted by the conservation and availability of pictures. The earlier periods of our time series do not include many paintings that have 'portrait' or 'landscape' as a genre because these genres did not develop until the sixteenth or seventeenth century. We decided not to restrict our searches exclusively to these genres because for any picture the reasoning behind measuring the face-to-frame and the relative horizon height are still the same: to estimate the choice of the artist for which and how much information to include. For this same reason we included different types of art (representations): paintings, etchings and drawings. Different techniques of representations should not interfere with the choice to include information and indeed, Masuda et al. (2008) and Huang & Park (2012) find the same cultural differences for different types of media.

3.3.2 Analyses

Following the face-to-frame ratio method of Masuda et al. (2008), in each portrait the area of the face was determined by measuring the distance from the chin

to the top of the head, including hair or hat, and the longest horizontal distance across the face, excluding hair or hat. The frame area was measured from the inner border of the frame. The face-to-frame ratio is calculated as (face length * face width)/(frame length * frame width). In each landscape the relative horizon height was determined by measuring the distance from the lower edge of the painting to the horizon height, divided by the total height of the painting. In the case of a sloping horizon the slope was drawn across the painting and the average horizon height was used.

Regression analysis was used to find out if there was any change over time. For analysing looseness/tightness in our data we used twenty images from around the particularly high or low periods and calculated the differences in range of ratios per period. For this measure we first calculated the mean ratio of the period, and then determined the absolute difference between each ratio in the period and its mean ratio. Kruskal-Wallis tests showed if there were significant differences between periods, and if so post-hoc analyses using a non-parametric analogue to the Tukey test (Zar, 1999, p. 223) showed which period was different.

3.4 RESULTS

3.4.1 Dutch portraits

Face-to-frame ratio. The overall mean ratio for the Dutch portraits is 11.77% (M = .1177, SD = .1251). Regression analysis shows that the best fit is a quadratic model ($F(2, 202) = 31.37$, $R^2 = .24$, $p < .0005$, Figure 6), with a high initial ratio dropping to a vertex minimum of .0541 (the face covering 5.41% of the total area) around the year 1715, followed by an increase to the present day. To further visualise the change over time sets of 20 portraits from three periods are depicted in Figure 7.

These are the earliest measured period (M = .1240, SD = .1049), the middle period around 1715 (M = .0538, SD = .0507), and the last period (M = .2712, SD = .2565).

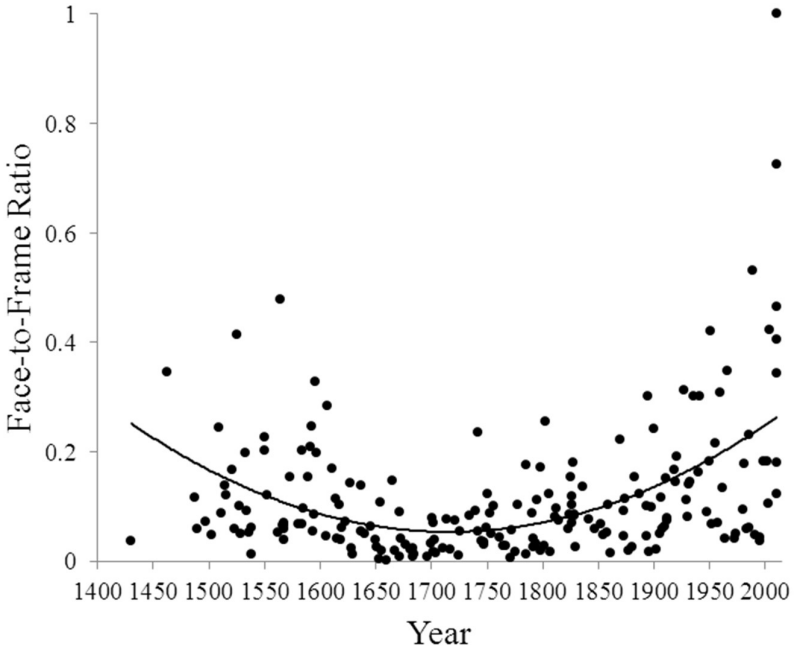

Figure 6: Change over time in face-to-frame ratio for Dutch portraits, indicative of changes in cognitive style. A high face-to-frame ratio indicates a more analytic cognitive style typical of modern Western people, and a low face-to-frame ratio indicates a holistic cognitive style typical of modern East Asian people. The line represents the best-fit quadratic model specified in the text.

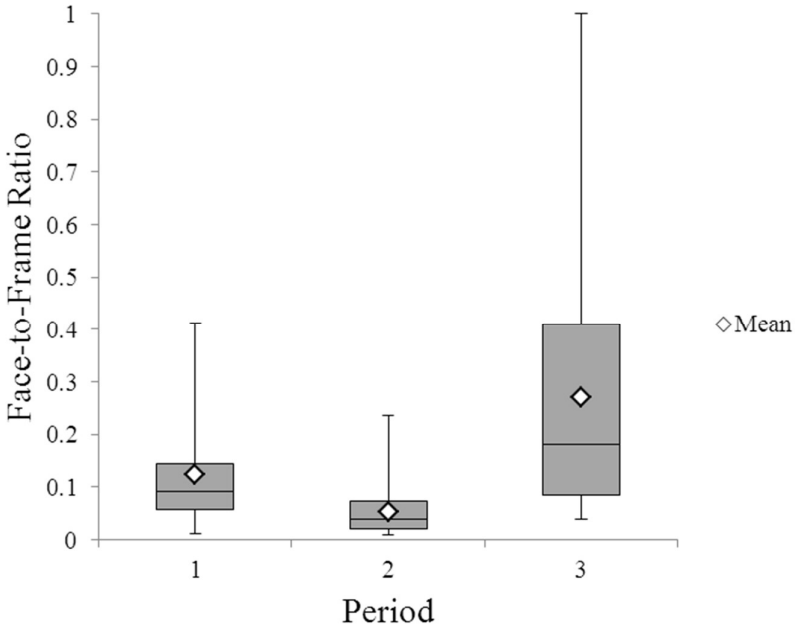

Figure 7: Visualisation of face-to-frame ratios in Dutch portraits. Periods encompass 20 portraits from the earliest measured time (period 1), the last measured time (period 3), and around the lowest point found (period 2). Error bars represent minimum and maximum values.

Variation. The periods have significantly different ranges of variations ($\chi 2(2, N = 60) = 32.08$, $p < .0005$, Figure 8). Post-hoc analyses show that the last period has a significantly larger range of ratios (M = .1996, SD = .1546) than both the first period (M = .0763, SD = .0698; $q_{\infty,3} = 4.62$, $p < .01$) and second period (M = .0336, SD = .0372; $q_{\infty,3} = 7.98$, $p < .001$), and the second period has a significantly smaller range of ratios than the first period ($q_{\infty,3} = 3.35$, $p < .05$).

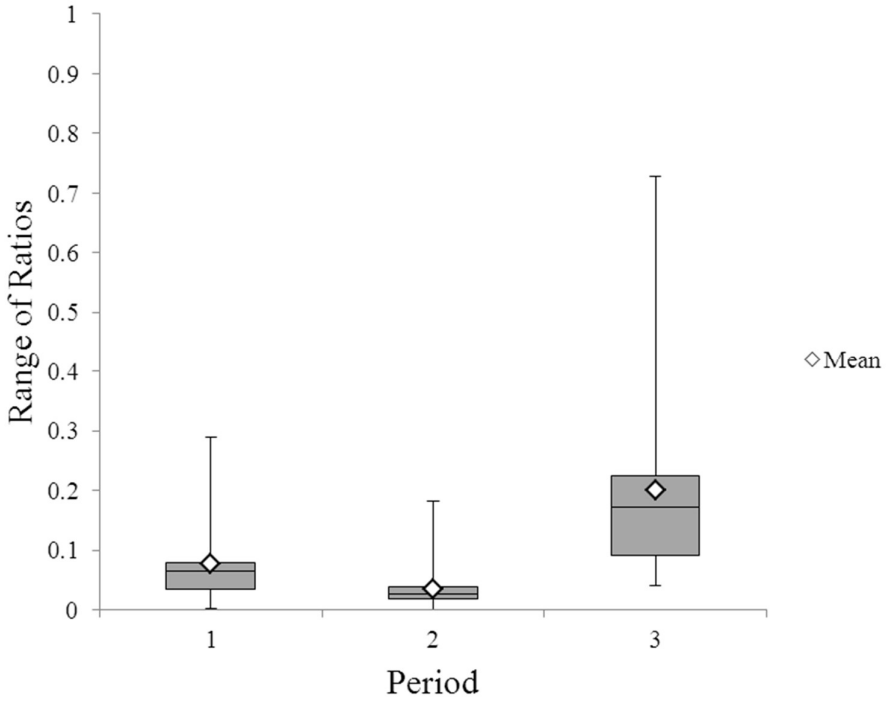

Figure 8: Dutch portraits in period 3 differ significantly more from their mean than portraits in periods 1 and 2. Portraits in period 2 differ significantly less from their mean than portraits in period 1. Error bars represent minimum and maximum values.

3.4.2 English portraits

Face-to-frame ratio. The overall mean ratio for the English portraits is 10.09% (M = .1009, SD = .1256). Regression analysis shows that the best fit is a quadratic model ($F(2,194) = 7.921$, $R^2 = .075$, $p < .0001$, Figure 9), with a high initial ratio dropping to a vertex minimum of .0683 (the face covering 6.83% of the total area) around the year 1703, followed by an increase to the present day. To further visualise the change over time sets of 20 portraits from three periods are depicted in Figure 10. These are the earliest measured period (M = .1015, SD = .0553), the middle period around 1703 (M = .0499, SD = .0354), and the last period (M = .2024, SD = .2806).

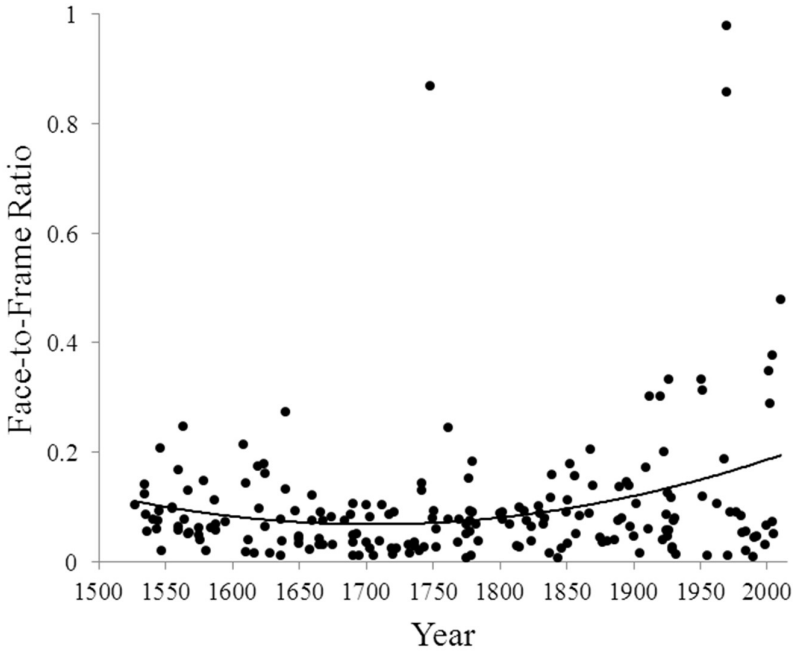

Figure 9: Change over time in face-to-frame ratio for English portraits, indicative of changes in cognitive style. A high face-to-frame ratio indicates a more analytic cognitive style typical of modern Western people, and a low face-to-frame ratio indicates a holistic cognitive style typical of modern East Asian people. The line represents the best-fit quadratic model specified in the text.

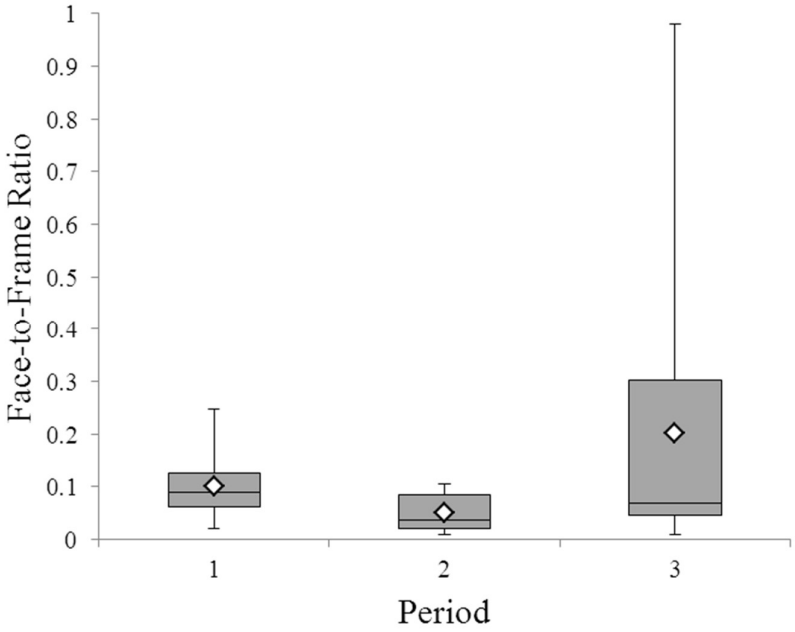

Figure 10: Visualisation of face-to-frame ratios in English portraits. Periods encompass 20 portraits from the earliest measured time (period 1), the last measured time (period 3), and around the lowest point found (period 2). Error bars represent minimum and maximum values.

Variation. The periods had significantly different ranges of variations ($\chi 2(2, N = 60) = 37.93$, $p < .0005$, Figure 11). Post-hoc analyses show that the last period (M = .2024, SD = .2806) has a significantly larger range of ratios than both the first period (M = .1015 , SD = .0553; $q_{\infty,3} = 7.26$, $p < .05$) and second period (M = .0499, SD = .0354; $q_{\infty,3} = 4.15$, $p < .01$).

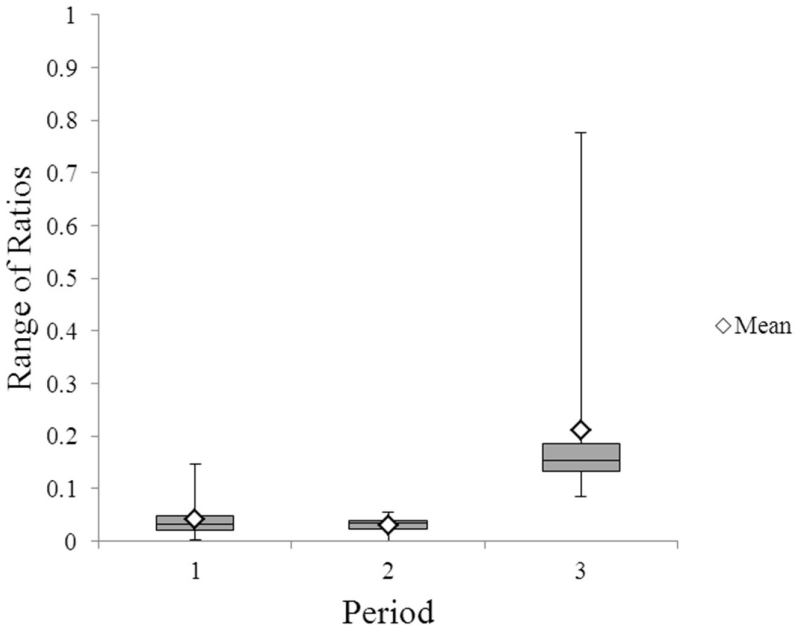

Figure 11: English portraits in period 3 differ significantly more from their mean than portraits in periods 1 and 2. The middle of the boxplot is the mean difference from the mean of the period ratios. Error bars represent minimum and maximum values.

3.4.3 German portraits

Face-to-frame ratio. The overall mean ratio for the German portraits is 11.07% (M = .1107, SD = .1227). Regression analysis shows that the best fit is a quadratic model ($F(2,224) = 9.886$, $R^2 = .081$, $p < .0001$, Figure 12), with a high initial ratio dropping to a vertex minimum of .0789 (the face covering 7.89% of the total area) around the year 1617 followed by an increase to the present day. To further visualise the change over time sets of 20 portraits from three periods are depicted in Figure 13. These are the earliest measured period (M = .0828, SD =

.1069), the middle period around 1617 (M = .0587, SD = .0459), and the last period (M = .1720, SD = .1629).

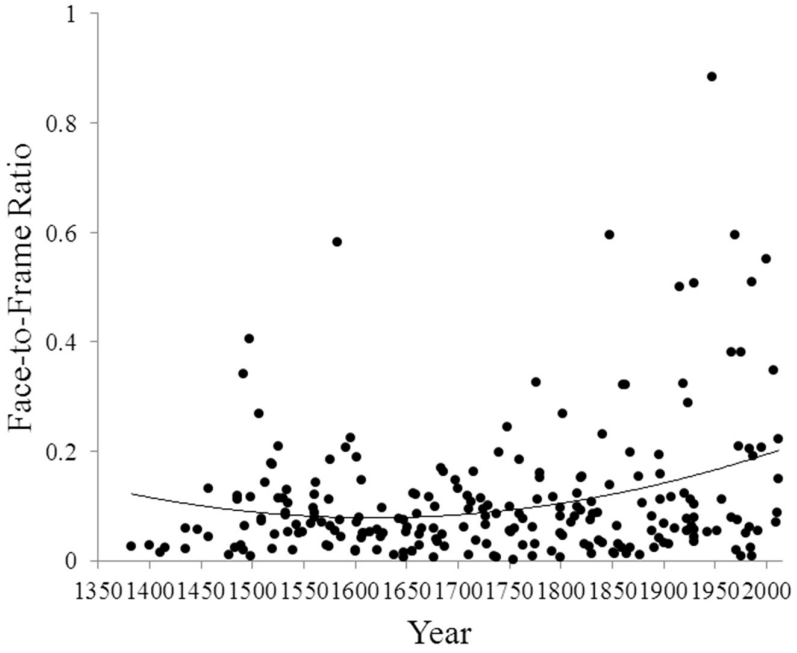

Figure 12: Change over time in face-to-frame ratio for German portraits, indicative of changes in cognitive style. A high face-to-frame ratio indicates a more analytic cognitive style typical of modern Western people, and a low face-to-frame ratio indicates a holistic cognitive style typical of modern East Asian people. The line represents the best-fit quadratic model specified in the text.

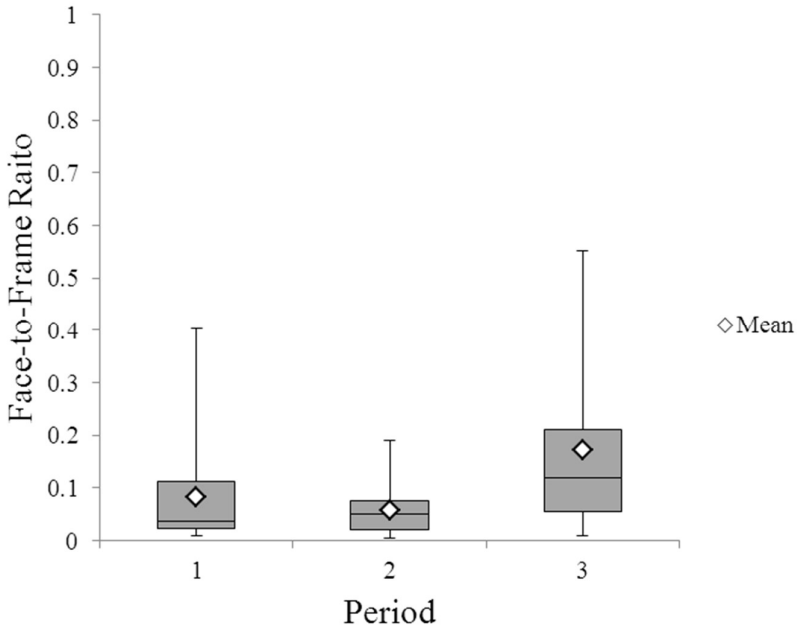

Figure 13: Visualisation of face-to-frame ratios in German portraits. Periods encompass 20 portraits from the earliest measured time (period 1), the last measured time (period 3), and around the lowest point found (period 2). Error bars represent minimum and maximum values.

Variation. The periods have significantly different ranges of variations ($\chi 2(2, N = 60) = 19.68$, $p < .0005$, Figure 14). Post-hoc analysis show that the last period has a significantly larger range of ratios (M = .1275, SD = .0971) than the second period (M = .0325, SD = .0316; $q_{\infty,3} = 6.22$, $p < .001$), and the first period (M = .0727, SD = .0766) has a significantly larger range of ratios than the second period ($q_{\infty,3} = 3.314$, $p < .05$). There is no significant difference between the range of ratios of the first and last periods.

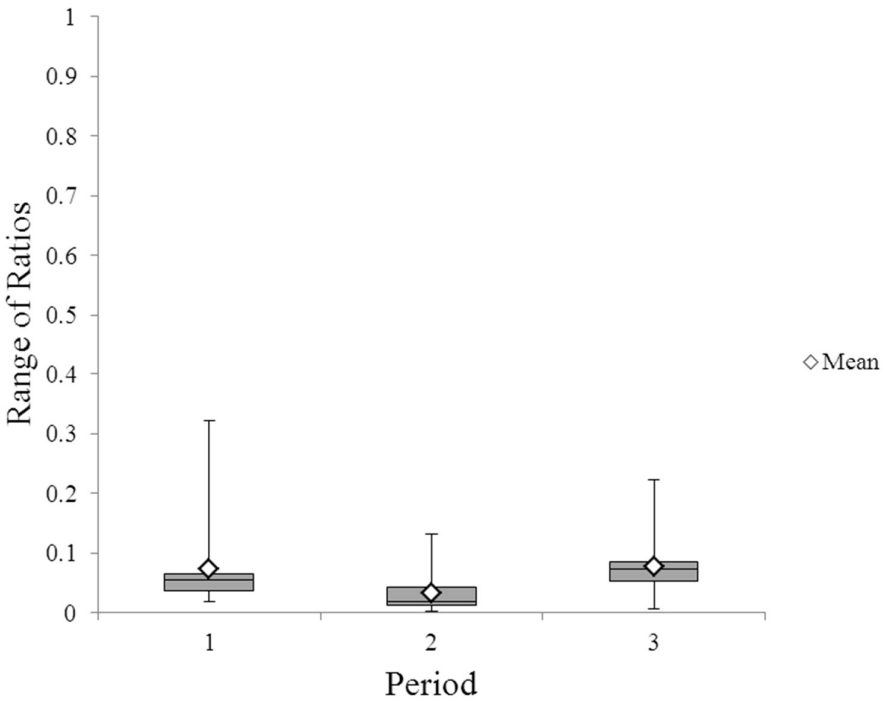

Figure 14: German portraits in period 2 differ significantly less from their mean than portraits in periods 1 and 3. The middle of the boxplot is the mean difference from the mean of the period ratios. Error bars represent minimum and maximum values.

3.4.4 Dutch landscapes

Relative horizon height. The overall mean of the relative horizon height for landscape paintings was 50.32% (M = .5032, SD = .2215). Following the same methods as for portraits, regression analysis shows best fit to be a quadratic model ($F(2, 204) = 61.47$, $R^2 = .376$, $p < .0001$, Figure 15), with a high initial ratio dropping to a vertex minimum of .3707 (the horizon at 37.07% of the total height of the painting) around the year 1800, followed by an increase to the present day. To further visualise the change over time sets of 20 portraits from three periods are depicted in Figure 16. These are the earliest measured period (M = .8039, SD = .0907), the middle period around 1800 (M = .2960, SD = .0787), and the last period (M = .5164, SD = .1833).

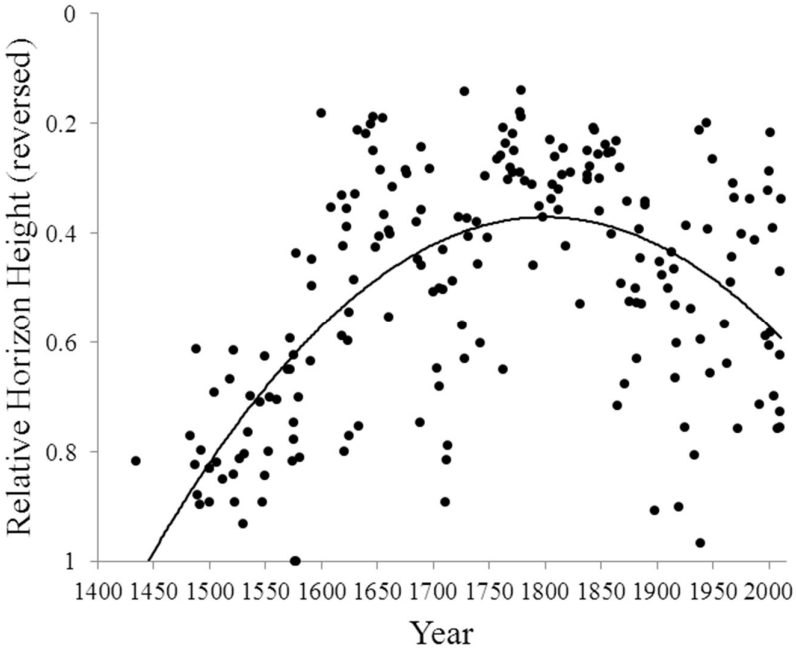

Figure 15 Change over time in relative horizon height for Dutch landscapes, indicative of changes in cognitive style. Values are depicted in reverse order to indicate analyticism at the top and holism at the bottom. A low relative horizon height indicates a more analytic cognitive style typical of modern Western people, and a high relative horizon height indicates a holistic cognitive style typical of modern East Asian people. The line represents the best-fit quadratic model specified in the text.

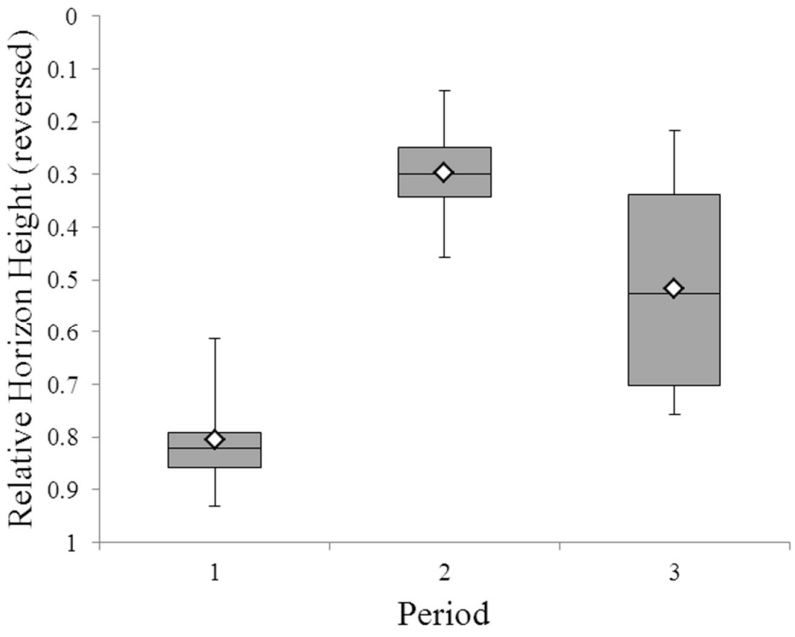

Figure 16: Visualisation of relative horizon heights in Dutch landscapes. Periods encompass 20 portraits from the earliest measured time (period 1), the last measured time (period 3), and around the lowest point found (period 2). Error bars represent minimum and maximum values.

Variation. The periods have significantly different ranges of variations ($\chi 2(2, N = 60) = 21.65$, $p < .0005$, Figure 17). Post-hoc analyses show that the last period has a significantly larger range of ratios (M = .1651, SD = .0701) than both the first period (M = .0666, SD = .0596; $q\infty,3 = 5.45$, $p < .001$) and second period (M = .0590, SD = .0504; $q\infty,3 = 5.92$, $p < .001$). The first and second periods do not show a significant difference in range.

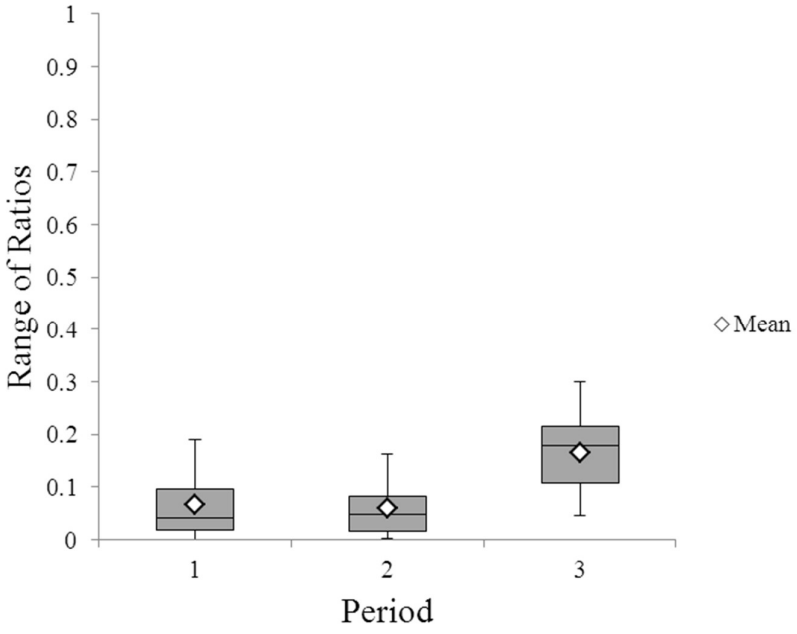

Figure 17: Dutch landscapes in period 3 differ significantly more from their mean than landscapes in periods 1 and 3. Error bars represent minimum and maximum values.

3.4.5 English landscapes

Relative horizon height. The overall mean of the relative horizon height for English landscape paintings was 54.93% (M = 54.93, SD = .2149). Regression analysis shows the best fit to be a quadratic model ($F(2,187) = 7.085$, $R^2 = .070$, $p < .001$, Figure 18), with a high initial ratio dropping to a vertex minimum of .4915 (the horizon at 49.15% of the total height of the painting) around the year 1743, followed by an increase to the present day. To further visualise the change over time sets of 20 portraits from three periods are depicted in Figure 19. These are the earliest measured period (M = .5968, SD = .2236), the middle period around 1743 (M = .4977, SD = .1766), and the last period (M = .6163, SD = .2086).

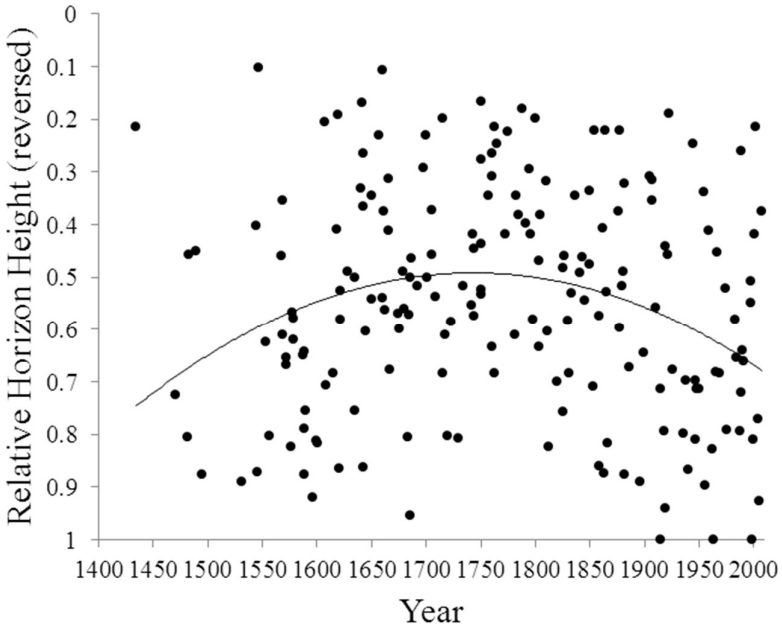

Figure 18: Change over time in relative horizon height for English landscapes, which shows no significant change in cognitive style. Values are represented in reverse order to indicate analyticism at the top and holism at the bottom. Contrary to expectation, relative horizon height is consistently as high as has been measured before for East Asian art. The line represents the best-fit quadratic model specified in the text.

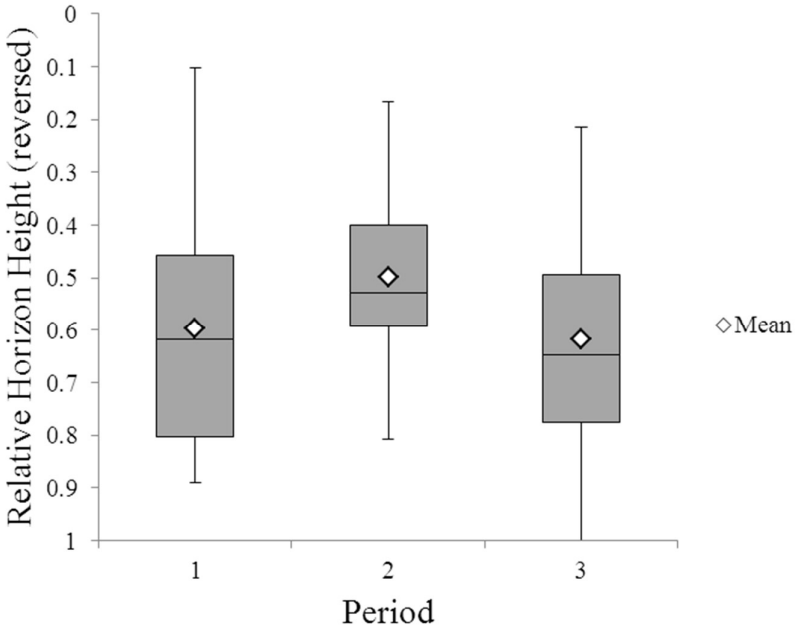

Figure 19: Visualisation of the relative horizon heights in English landscapes. Periods encompass 20 portraits from the earliest measured time (period 1), the last measured time (period 3), and around the lowest point found (period 2). Error bars represent minimum and maximum values.

Variation There are small differences in the range of ratios per period which are not significantly different ($\chi 2(2, N = 60) = .961$, $p = .62$, Figure 20). The same pattern as in other cases occur where the second period (M = .1382, SD = .1053) has the lowest value compared to the first period (M = .1785, SD = .1284) and the last period (M = .1671, SD = .1189.)

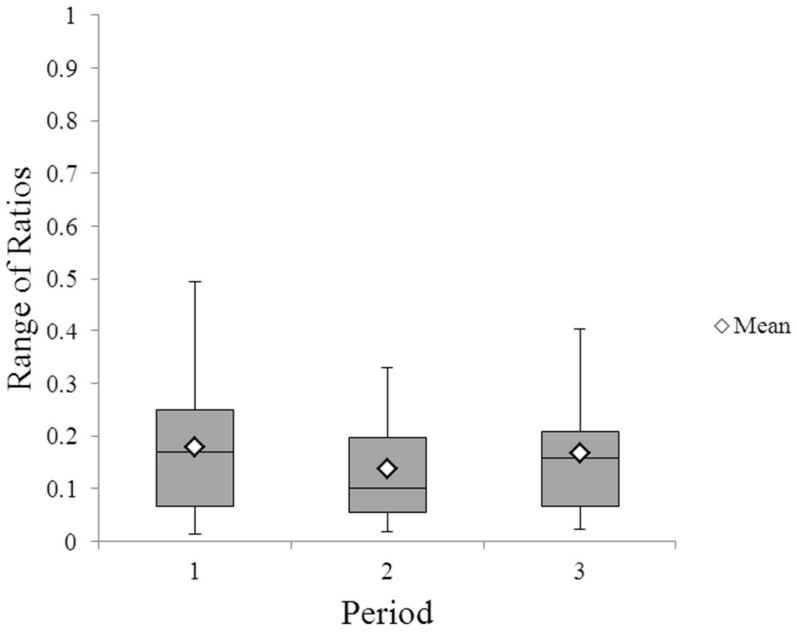

Figure 20: English landscapes show no significantly different variations. The middle of the boxplot is the mean difference from the mean of the period ratios. Error bars represent minimum and maximum values.

3.4.6 German landscapes

Relative horizon height. The overall mean of the relative horizon height for German landscape paintings was 60.19% (M = .6019, SD = .1954). The best fit is a quadratic model ($F(2,231) = 14.320$, $R^2 = .110$, $p < .0001$, Figure 21), with a high initial ratio dropping to a vertex minimum of 0.5435 (the horizon at 54.35% of the total height of the painting) around the year 1815, followed by an increase to the present day. To further visualise the change over time sets of 20 portraits from three periods are depicted in Figure 22. These are the earliest measured period (M = .6895,

SD = .2263), the middle period around 1815 (M = .5295, SD = .1723), and the last period (M = .6150, SD = .2331).

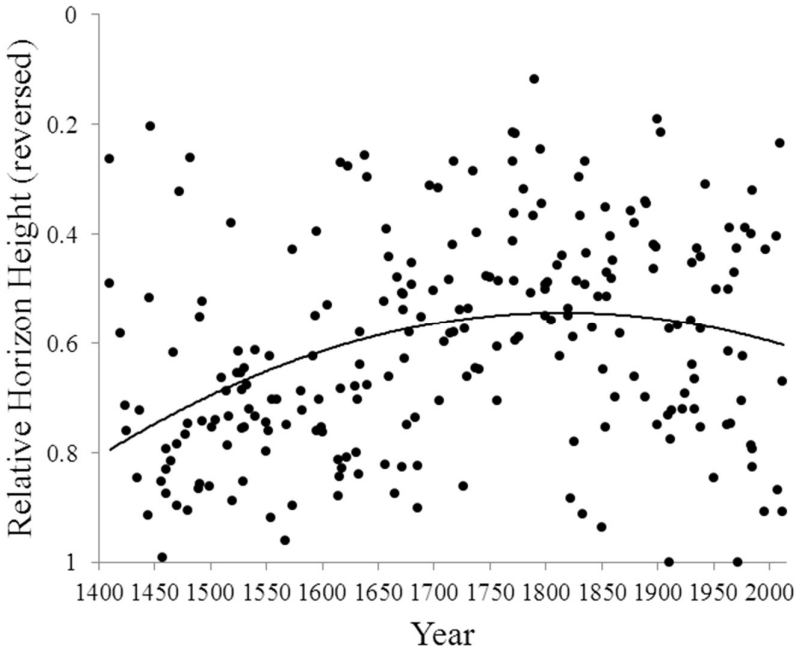

Figure 21: Change over time in relative horizon height for German landscapes, which shows no significant change in cognitive style. Values are depicted in reverse order to indicate analyticism at the top and holism at the bottom. Contrary to expectation, relative horizon height is consistently as high as has been measured before for East Asian art. The line represents the best-fit quadratic model specified in the text.

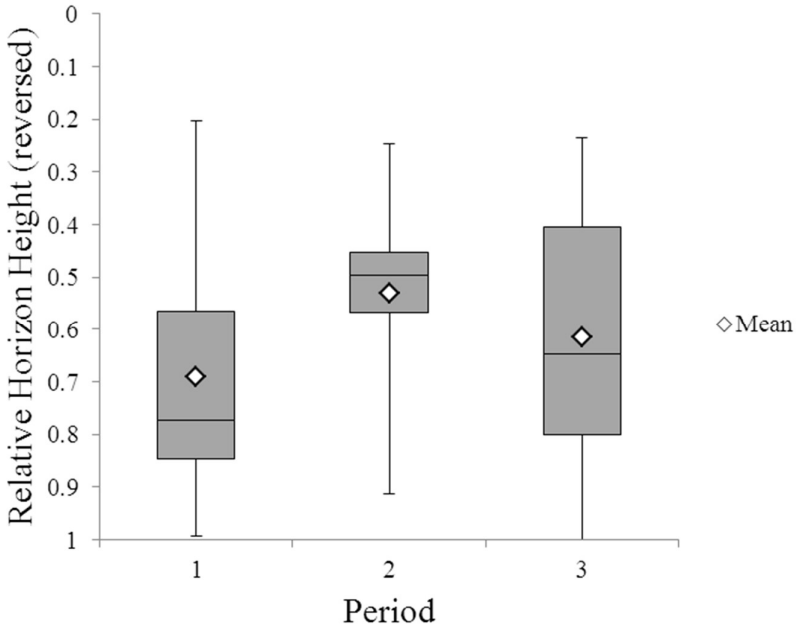

Figure 22: Visualisation of the relative horizon heights in German landscapes. Periods encompass 20 portraits from the earliest measured time (period 1), the last measured time (period 3), and around the lowest point found (period 2). Error bars represent minimum and maximum values.

Variation. The periods have significantly different ranges of variations ($\chi 2(2, N = 60) = 7.437$, $p < .05$, Figure 23). Post-hoc analysis show that the last period has a significantly larger range of ratios (M = .2071, SD = .0958) than second period (M = .1217, SD = .1187; $q_{\infty,3} = 3.83$, $p < .05$). The first period (M = .1835, SD = .1257) does not show a significant difference in range from either second or last period, but a similar pattern is again upheld where the range is larger than in the second period.

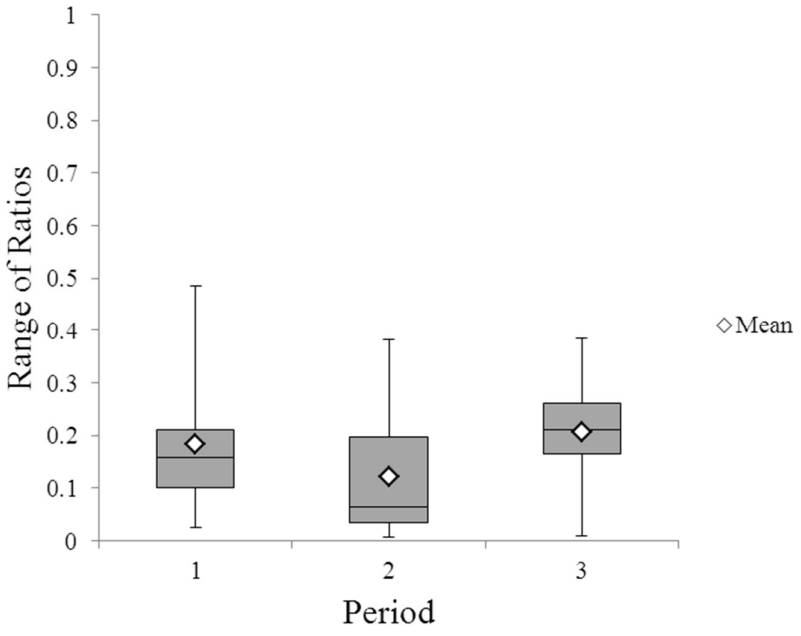

Figure 23: German landscapes in period 3 differ significantly more from their mean than landscapes in period 2. The middle of the boxplot is the mean difference from the mean of the period ratios. Error bars represent minimum and maximum values.

Although no statistical analysis was possible, Figure 24 and Table 2 compare Masuda et al's (2008) findings for portraits with those from the present study. Comparing these it appears that portraits in the middle periods of all three countries are more like what Masuda et al (2008) found for East Asian portraits than for Western ones, while all three countries show contemporary face-to-frame ratios more alike Masuda et al's (2008) findings for Western art. For landscapes (Figure 25 and Table 3) the comparison results in a different view: with the exception of the middle period in Dutch landscapes, all periods show a relative horizon height more comparable with East Asian than with Western measures.

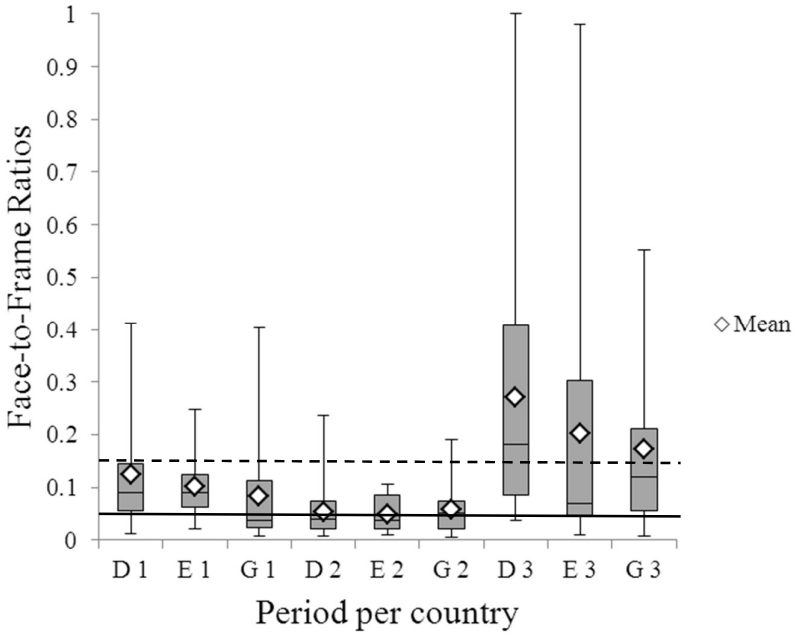

Figure 24: Comparison of Masuda et al's (2008) findings for Western (14.65%, dashed line) and East Asian (4.28%, uninterrupted line) portraits from museums, and the findings for the Dutch (D), English (E) and German (G) first (1), middle (2) and last (3) periods. Error bars represent minimum and maximum values.

Table 2: Comparison of Masuda et al's (2008) findings for Western and East Asian portrait paintings from museums, and the relevant findings for the Dutch, English and German timelines. Underscored = typical Western ratios, bold = typical East Asian ratios. *[x] = significant difference with period x.

Portraits			
Western museums (Masuda et al 2008)		14.65	
East Asian museums (Masuda et al 2008)		**4.28**	
Dutch mean		11.77	
Dutch change in time	12.40*[2]	**5.38***[1,3]	27.12*[2]
English mean		10.09	
English change in time	10.15*[2]	**4.99***[1]	20.24
German mean		11.07	
German change in time	**8.28**	**5.87***[3]	17.20*[2]

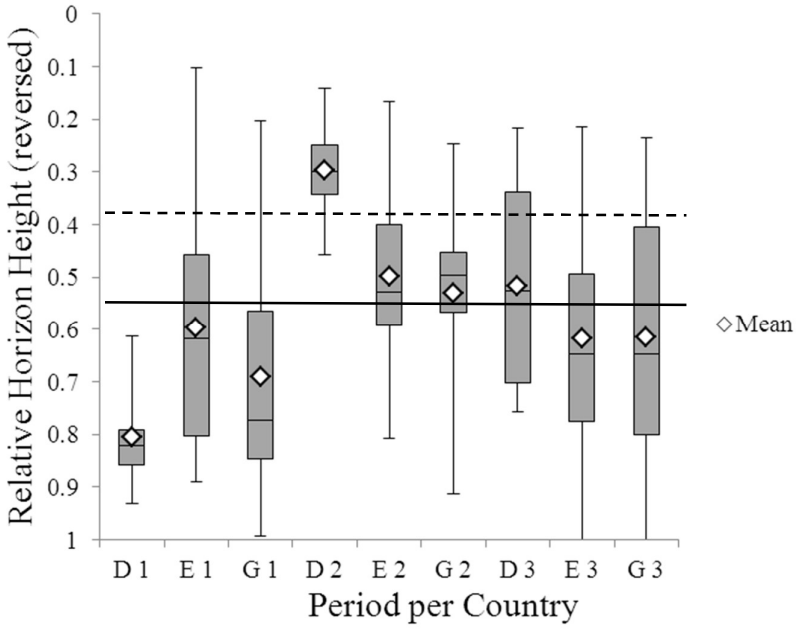

Figure 25: Comparison of Masuda et al's (2008) findings for Western (38.83%, dashed line) and East Asian (56.15%, uninterrupted line) landscapes from museums, and the findings for the Dutch (D), English (E) and German (G) first (1), middle (2) and last (3) periods. Error bars represent minimum and maximum values.

Table 3: Comparison of Masuda et al's (2008) findings for Western and East Asian landscape paintings from museums, and the relevant findings for the Dutch, English and German timelines. Underscored = typical Western ratios, bold = typical East Asian ratios. *,x = significant difference with period x.

Landscapes			
Western museums (Masuda et al 2008)		<u>38.83</u>	
East Asian museums (Masuda et al 2008)		**56.15**	
Dutch mean		**50.32**	
Dutch change in time	**80.39***[2,3]	<u>29.60</u>*[2,3]	**51.64***[1,2]
English mean		**54.93**	
English change in time	**59.68**	**49.77**	**59.68**
German mean		**60.19**	
German change in time	**68.95**	**52.95**	**61.50**

A summary of ranges of ratios and significant differences between them can be found in Table 4, which shows that the most often found pattern is a significant increase in range size from the middle period to the last period.

Table 4: Summary of ranges of ratios for portraits and landscapes, for all three measured periods. The relative position of the number indicates the width of the range. → p<.05; ➔ p<.01; ⇒ p<.001.

Series	Period 1	Period 2	Period 3
Dutch Portraits	.0763	.0336	.1996
English Portraits	.1015	.0499	.2024
German Portraits	.0727	.0325	.1275
Dutch landscapes	.0666	.0590	.1651
English landscapes	.1785	.1382	.1671
German landscapes	.1835	.1217	.2071

3.5 DISCUSSION

3.5.1 Findings for analytic/holistic cognition

As expected for all three countries the means of the face-to-frame ratios are in line with the mean Western face-to-frame ratio found in museums by Masuda et al. (2008), rather than with the mean East Asian face-to-frame ratio, (Netherlands 11.77%, England 10.09%, Germany 11.07%, Western 14.65%, East Asian 4.28%, Table 2).

The face-to-frame ratios for portraits in the Netherlands show a high initial ratio (12.40%), which drop until the early 18th century where they become significantly lower (5.38%), after which follows a rise until present day when levels are significantly higher than in the early 18th century (27.12%). In English portraits we see a similar pattern where the initial ratio is fairly high (10.15%), drops until a low point in the early 18th century when ratios are significantly lower than before (4.99%), followed by a rise until high face-to-frame ratios of contemporary art (20.24%) but this rise nonetheless does not result in a significant difference between middle and last period. German portraits show a slightly different pattern, with a relatively *low* initial ratio (8.28%), followed by a slight non-significant decrease to the early 17th century (5.83%), but then ratios climb up until a significant increase in ratios is reached (17.20%). In sum, for all three countries the face-to-frame ratio starts out at high or intermediate values indicating relatively analytic or intermediate cognition, then dips to a low point around the 17th to 18th century indicating holistic cognition, before increasing to high and analytic present day values.

Contrary to expectation in all three countries the mean relative horizon height over time was more comparable to what Masuda et al. (2008) found for East Asian paintings than to findings for Western paintings (the Netherlands 50.32%, England

54.93%, Germany 60.19%, East Asian 56.15%, Western 38.83%, Table 3). The relative horizon height for landscapes in the Netherlands started very high (80.39%), then dropped significantly until the late 18th/early 19th century (29.60%), followed by a rise until current day levels (51.64%) which are significantly higher than the middle period but significantly lower than the earliest period. Conversely, relative horizon heights for England and Germany show no significant changes and are consistently high throughout time.

The relative horizon heights in the pictures collected in this project do not match what has been found for Western paintings by Masuda et al. (2008), but instead show a high level of holism. These findings are not in line with the literature where Western societies have been found to be analytic, and are also not in line with what was found in the face-to-frame ratio in the portraits. As will be confirmed in the following two chapters (Chapters 4 and 5), it appears that the relative horizon height is not a good measure for historical analyticism/holism, and therefore we will not take results into consideration. Two possible causes for the discrepancy come to mind. The first is that it may be due to the fact that the relative horizon height is a proxy for a proxy: it indicates perspective taking vs. bird's eye view, which indicates the possible inclusion of more or less additional information. Since in Chapters 4 and 5 the relative horizon height does not correlate with the number of additional objects, this is likely not an appropriate line of reasoning. For instance, even with a very low horizon, there may be additional items *above* the horizon as well: birds, clouds, planes, etc. Even though we controlled for deities in the sky, Masuda et al. (2008) may not have controlled for this in their museum paintings, though their laboratory study does show lower horizons for Western students as well. Also there may be other factors that determine the height of the horizon other than the need to get

objects into a painting or perspective taking, such as an appreciation for land as the basis for life. The second cause might be the method of selection intrinsic to the historical study. Masuda selected Western paintings from museum websites by searching on the key word 'landscape'. Landscape painting as a genre developed in the Netherlands in the 17th century during the Golden Age and the style spread to other countries after that time. Searching on the key word 'landscape' may thus have led Masuda to find paintings in the *genre* 'landscape', with a bias for after the 17th century. Because we made time series going back as far as we could, we selected paintings according to the spirit of the method: where we could see a horizon, based on the argument that a higher horizon comes from taking a birds-eye view and including elements in the landscape that cannot be seen together from the ground, which is thought to be a mark of holistic cognition. A lower horizon leaves little space for additional information which shows an analytic cognition. By this reasoning it should not have mattered that we included paintings of any genre showing a horizon. The discrepancy indicates that the meaning of a horizon is not pinned down precisely.

The significant changes in face-to-frame ratio over time reject the first hypothesis and show that Western analyticism has not been consistently maintained since ancient Greek times, but shows a rather more dynamic pattern. The second hypothesis stated that when farming was prevalent holistic cognition would have been the standard, which changed to analyticism once farming decreased (Nisbett & Masuda, 2003). The data also do not support this hypothesis since initially, while agriculture and especially growing crops were the common means of acquiring subsistence, the face-to-frame ratios for the Netherlands and England start off significantly *higher* (more analytical) than in the middle period, not lower or equally

low (Slicher van Bath, 1963). However, the German data from the earliest period does start out low, remains low and only become recognisably Western in recent times, which does support the hypothesis.

3.5.2 Findings for tightness/looseness

The data also reject the hypothesis that the level of tightness/looseness is maintained consistently throughout time. Since the landscape series gave such anomalous findings I only consider the portrait series here. In the three portrait series, we find the same pattern: intermediate variation in the first period, little variation in the middle period and large variation in the last period (Table 4). All three datasets show significantly larger ranges of variation for contemporary work than for images from the middle periods. In Dutch and German portraits the first period also shows significantly larger ranges than the middle period, but not in the English portraits. In Dutch and English portraits the earliest period also shows a significantly smaller range than in the last period, but this is not the case for German portraits. The consistent differences between the middle and last periods across all three countries indicate a relatively recent change in all three societies from tightness to looseness, showing that tightness/looseness, like analytic/holistic cognition, is dynamic and not static in terms of centuries.

3.5.3 Methodological issues

Some methodological issues should be discussed. It is possible that unforeseen biases have influenced our data in some way, for example the curators of the databases we consulted may have chosen to include some works or genres rather than others. However if this is the case it will have been unintentional: none of the databases made any artistic preference explicitly clear. Additionally we took care to

select pictures systematically: we checked each website for any sorting of work when giving search results. When we found a sorting method (for example, presentation in alphabetic order) we made sure to skip pages and even out selection as much as possible.

Another way our data may have been influenced is that paintings may have been destroyed or altered for some reason, without us knowing about it. However, the databases from which we collected our paintings were websites used by art critics and historians and it was stated whether illustrations on their websites were details of originals, or if they had been cropped. Furthermore, for destruction or alteration to have an influence on our data it would have to be *systematic*, not incidental, destruction or alteration of a specific style or period of paintings, but not of other styles or periods of paintings, which seems unlikely. If at any point in time such a deliberate attempt would have been undertaken, we would assume that those doing the adjusting would change art in a uniform fashion according to some ideal. This would have made art *more uniform*, while we see that it continuously changes over time.

The last question is whether an artists' style represents cognition of the general population. Artists' personalities were found to differ from non-artists in having higher scores on neuroticism (measured with Eysenck scale, Götz & Götz, 1979). This should not be a reason for discrediting the present study since most findings in psychology are based on populations that may arguably not be like the rest of society, like students (Henrich, et al., 2010), other academics (Schwartz, 1994), or IBM employees (Hofstede, 2001; Hofstede, et al., 2010). Furthermore Masuda et al. (2008) measured images from both artists and students, and found the same pattern, though admittedly with slightly different values. Besides that,

successful artists have a clientele to satisfy, who may be individuals contracting them, or buyers from the public. It would therefore be logical that artists have at least some sense of what is generally popular among the public.

3.5.4 Historical analysis in view of the data

Here it has been shown that analytic/holistic cognition and tightness/looseness are dynamic and not static, and that dependence on farming is not likely to be a key factor. These time series suggest that during the middle periods people were more holistic and had tighter norms than at present, and to a lesser extent than the first periods. Several factors have been indicated in the literature to differ between tight and loose societies (see section 2.3.2) and some (though not with any statistical analysis) between analytic and holistic cognition societies (see section 2.3.1). From Gelfand et al.'s (2011, supplement) list of correlates with tightness/looseness, one factor stands out as being saliently relevant to our data: the number of threats from neighbouring nations for integration and annexation, or territorial threats, from 1918-2001, which was found to be significantly higher for tighter than looser nations.

Questions about the effect on cultural constructs under territorial threat have also arisen from the novel research program of historical dynamics (Turchin, 2008), which aims to mathematically capture major patterns in history with models derived from population genetics. This research program would be helped by insight and measurements on what is called *asabiya:* 'group feeling', or the capacity for collective action that plays a central role in the formation of socially coherent groups (Turchin, 2003). *Asabiya* comes from "social intercourse, friendly association, long familiarity, and companionship" (Ibn Khaldun, in Turchin, 2003, p. 39). In the context of a group facing out-group threat, it produces "the ability to defend oneself,

to offer opposition, to protect oneself, and to press one's claims", which enables a group to maintain autonomy (Ibn Khaldun, in Turchin, 2009, p. 195). It includes a strong inward looking attitude or preference for in-group members over out-group members. Conceptually, several cultural constructs could be related to the in-group preference in *asabiya,* such as collectivism (which Turchin, 2003 mentions), egalitarianism, holism, tightness, civic participation, etc. Indeed, war, inter-group competition and violence have been shown to induce greater pro-sociality towards the in-group as opposed to the out-group. In the case of civil war in Sierra Leone, individuals who experienced personal loss and trauma, post-war showed increased participation in voting and public goods (Bellows & Miguel, 2009). Further evidence for increased pro-sociality in Sierra Leone was found through economic games (Bauer, Cassar, Chytilova, & Henrich, 2013), which showed that more affected people were more egalitarian towards the in-group and more selfish towards the out-group, than less-affected people. The same was found with participants from Georgia, which had recently been in an inter-state war with Russia (thereby also showing that there is no difference in effects in these areas between civil war and inter-state war) (Bauer, et al., 2013). The civil war in Burundi has also had similar effects, where more affected individuals show increased altruism towards their in-group, and also are more risk-seeking and have higher discount rates (Voors, et al., 2012). Further interesting and important findings are that there is a developmental period, between the ages of 7 and 20, where war trauma has a lasting pro-sociality effect (Bauer, et al., 2013). Also war often does not have detrimental economic consequences for the country, but rather there is a rapid post-war catch-up growth, as predicted by economic models (see Bellows & Miguel, 2009).

This growing body of work indicates increased *asabiya* when experiencing war. That war has been a major theme in Western Europe is clear, and although it may not singularly explain why analytic/holistic cognition and tightness/looseness changed so dramatically, it may have been an important factor. Following Plaut, et al. (2012), who in tandem with their empirical work presented short historical analyses of Boston and San Francisco to indicate long-standing cultural differences in conformity, I here present a short analysis of each country's history of war as relevant to our data.

Before the fifteenth century the Netherlands was a loose collection of counties, which nevertheless showed community through building the waterworks which were needed as protection against the sea (Blom & Lamberts, 1999). The period from the mid 16th to the mid 18th century was marked by war; first was the 80 Year War (1568–1648) against Catholic Spanish suppressors, set on by the rise of Protestantism. Even though a war was being fought, the first half of the 17th century brought prosperity, mainly due to colonisation and the innovation of joint stock companies. Mid 17th century the war against Spain was won, after which three wars were subsequently fought against France leaving the country in debt and diminished in power and wealth in the 18th century (Blom & Lamberts, 1999). Under threat of yet another war against France, in 1748 the counties are unified into one country and kingdom. Fierce nationalism and increased pauperism marked society. From 1780 onwards, politics started to become more and more recognizable in the contemporary situation, and from this time onwards Dutch culture is similar to modern Dutch culture. The coming period saw no wars on home territory, but the Dutch had colonies which it occupied by force. In World War I the Netherlands was neutral and

did not see much violence, but in World War II (1939-45) the country was occupied and lost 2.3% of its population (Blom & Lamberts, 1999).

England before the 19th century was continuously involved in war, though very few were fought on home territory. Conflicts were with France over territory, with Spain over religion, and with the Netherlands over rivalry in colonising South Asia. The Civil War (1642-51) with Scotland and Ireland however had an enormous popular involvement, and did take place much on English soil, seeing unprecedented levels of hostilities. Over the course of this war 180.000 English died, and 1 in 4 Englishmen served in the conflicts (Black, 1997). In 1707 England and Scotland unified into the Kingdom of Great Britain. Post-war during the 18th century morality and etiquette were strongly present in society. After the civil war no others were fought on English soil although many were fought abroad. Despite losing North America in 1783 Great Britain gains top position in terms of colonies. The Industrial Revolution (approx. 1780-1840) started in Great Britain, or rather in England, because it had several advantages over other countries: it already had a commercially minded agriculture system—with a few large landowners employing people and producing mainly for market, for private gain—instead of having subsistence economy. This produced higher yields and thus could feed more non-farming people who were then a readily available workforce for the rising industry (Hobsbawm, 1962). Although Great Britain's involvement in both World Wars did not include battles on home territory, 2.19% of the population was lost in WWI, and 400.000 people (0.94%) in WWII (Weinberg, 1994).

Germany has had a remarkable history in the sense that many historians have asked the question of why Germany became unified 'too late', or at least much later than other European countries. "The Germans retained the ability to feel as a nation

but did not acquire the capacity to act as a state" (Balfour, 1992, p. 1). For most of its history it was the centre of the Holy Roman Empire (962-1806) though this was only in name, since mostly it was a gathering of principalities, duchies and other smaller units, under control by their own rulers. Around the 14th century these towns perpetually feuded with each other (Fulbrook, 1990). From the mid 15th to the mid 17th century there were periodic peasants' revolts, including those following from Martin Luther's theses in 1517, calling for people to take personal responsibility in their faith. The Thirty Years War (1618–1648) which involved many other European countries was fought initially over religion, and later over power and rule. An estimated 20 to 33% of the total German population died and much farm land was lost because of the scorched earth technique. After the war ended in 1648, some historians estimate that it took the Germans a century to get back to pre-war levels, while England was rapidly expanding. Germany is finally united in 1871 but in the following century waged most horrific wars on its neighbours, losing 3.82% in WWI and over 4 million (7.9-10%) of its population in WWII (Weinberg, 1994).

These histories show territorial war was certainly an integral part of life during the periods of both holism and tightness. The Netherlands saw strong holism and tightness around the early 18th century, which coincides with unification after two centuries of war. England's period of strong holism and tightness was around the same time, early 18th century, which also coincides with a unification event and follows a massively deadly decade long war on home territory, and continuous war with neighbouring countries. Germany's most holistic period was in the early 17th century, during which also a bloody war on own territory was fought. However, Germany's delayed unification only took place in 1871, and Germany shows lower levels of analytic/holistic cognition than England or the Netherlands. Although not a

perfect fit, the data presented here shows connections to long periods of war that is fought at home or close to home. Given the recent studies on the effects of war on pro-sociality, I believe what is seen here expressed in holism and tightness, might be increased *asabiya* as a consequence of war. However, obviously the view on history given here is skewed and more sophisticated historical analysis should test this hypothesis to exclude other possible historical factors, but this is beyond the scope of the current thesis. Further future work should also include investigating the history of art in East Asian countries to validate the methods presented here.

3.5.5 Conclusions

In conclusion, here we have presented a novel method of investigating cognitive mode over time. It has shown that the cultural constructs of analytic/holistic cognitive mode and tightness/looseness are not static throughout time, but dynamic. Possible roads of inquiry for why these changes occurred should be sought with extreme inter-group conflict: war. This view is supported by an increasing number of studies discovering inter-personal and inter-group conflict strongly influence psychological constructs in humans. Future work should also include investigating the history of art in East Asian countries to validate the methods presented here.

CHAPTER 4: MORE AGREEABLE PEOPLE PREFER LARGER FACES - PERSONALITY AND ANALYTIC/HOLISTIC MODE

4.1 ABSTRACT

Based on society-level findings, the relationship between personality in terms of the Big Five dimensions, and markers of analytic/holistic cognitive mode found in pictures is tested on the individual level. Positive correlations are predicted between Extraversion, and face-to-frame ratio and number of additional items, while negative correlation is predicted between Extraversion and relative horizon height. No evidence for these relationships is found, but instead Agreeableness correlates positively with face-to-frame ratio. Because on a society-level Agreeableness correlates with UAI and Mas, and not with IDV, this finding implicates that the suggested relationship between analytic/holistic cognition and IDV might be premature.

4.2 INTRODUCTION

Studies of analytic/holistic cognitive mode show consistent differences between people from Western and East Asian countries, where Westerners use an analytic mode and focus on elements and categories, and East Asians use a holistic mode and focus on context and relationships between the parts (see section 2.3.1). In art this difference has also been shown: in a study of portrait and landscape paintings in museums, Masuda et al. (2008) found that Western portraits show significantly larger faces in relation to the frame than East Asian portraits, and that East Asian landscapes show higher horizons than Western landscapes. This pattern was reproduced in the laboratory: Western students who made a portrait photograph zoomed in more than East Asian students, and drew a lower horizon height in a

landscape drawing than East Asian students (Masuda, et al., 2008). Chapter 3 found similar means for contemporary Western portraits (though results for landscapes did not match the earlier work). Masuda et al. (2008) explained this and similar cognitive differences between East Asian and Western culture with the construct of analytic/holistic cognition: analytic Western painters place greater emphasis on the single focal individual in portraits and so make that individual relatively larger, whereas holistic East Asian portrait painters place greater emphasis on background contextual information so make the focal individual relatively smaller. Similarly, holistic East Asian landscape artists paint high horizons which allow more objects and individuals to be included in the painting, compared to analytic Western landscape artists.

The question remains how these findings relate to the rest of the findings in cultural psychology. In section 2.3.6 I identified two loosely integrated clusters of cultural constructs that are apparent at this time: the first was a cluster of IDV, PD, analytic/holistic cognitive mode, and tightness/looseness (both which might be connected through self-construal); the second was a less defined cluster of Agreeableness, high contributions and low punishment in the PGG, and low UAI and Mas. Here I investigate the possibility that these clusters are interconnected through investigating if there is a link between analytic/holistic mode which occurs only in the first cluster, and Big Five personality which only occurs in the second cluster. Analytic/holistic mode of thought has been said to be related to IDV (Ishii, 2013), underpinned by self-construal (Gardner, et al., 1999; Kühnen, et al., 2001; Kühnen & Oyserman, 2002), where analytic mode, high IDV and independent self-construal form one end of the scale, and holistic mode, low IDV and interdependent self-construal the other. IDV has been found to correlate with Extraversion (with

coefficient $r = .64$) and not with any of the other personality dimensions (Hofstede & McCrae, 2004). Therefore a link may be expected where Extraversion correlates positively with analytic mode of thought. Here I test this link on participants in a laboratory, who will fill out a commonly used personality questionnaire, take a portrait photograph and draw a landscape picture.

The cultural differences in personality and Hofstede's dimensions were found on the group-level (Hofstede & McCrae, 2004), while we predict the relationship between extraversion and analytic cognition at an individual-level. Correlations between groups do not always predict correlations within groups (Na, et al., 2010) and so we cannot assume that individuals possess the combination of traits their culture does. Nevertheless, Masuda et al. (2008) verified their museum findings with student participants tested in the laboratory, making the link between East Asians and holistic mode, and Westerners and analytic mode, clear on an individual level. Also, society-wide differences in terms of the Big Five correspond to individual-level differences, making personality an aggregate factor, not an emergent factor (meaning the group characteristic is the total of its parts, not *more* than the sum of its parts, McCrae, Terracciano, & 79 members of the Personality Profiles of Cultures Project, 2005a).

Further support for the validity of our question comes from the field of art psychology. This field has extensively studied the relationship between art preferences and personality, albeit based on art movements and not on specific measurable details as I investigate in the present study. One large-scale investigation (Chamorro-Premuzic, Reimers, Hsu, & Ahmetoglu, 2009) found that on an individual level, people who scored higher on Extraversion preferred cubism over other styles, and people that scored higher on Agreeableness and Conscientiousness,

and lower on Openness to experience, tended to prefer impressionism over cubism, renaissance art and Japanese art (Chamorro-Premuzic, et al., 2009). Although it is beyond the scope of this thesis to investigate it further, if these art movements differ in the measures investigated by Masuda et al. (2008) this could be an interesting crossover.[12] Since this study was done on an individual level, the current study is justified in testing it at that same level.

Conceptually one could imagine these factors being related at the interpersonal level. Individualistic societies emphasise personal uniqueness, which could be expressed at an interpersonal level as extraversion, which facilitates the expression of that uniqueness to others, and could therefore be expressed in paintings as a focus on the individual face to the exclusion of contextual objects. Collectivist societies value similarity in behaviour and the de-emphasis of personal uniqueness, which could reduce extraversion at an interpersonal level and thus decrease the interest in individually unique faces/individuals within art. This would predict, therefore, a hitherto undemonstrated relationship between Extraversion and preference for analytic aspects in art: more extraverted people should prefer pictures with larger faces, which is more typical of analytic societies.

4.3 METHODS

4.3.1 Participants

Sixty undergraduate students from Queen Mary, University of London took part in this study (12 male, 48 female), who were paid £4 for 30 minutes of their

[12] Some elements of these art styles are somewhat reminiscent of the current topic of investigation: renaissance art is very rich in detail and has many additional items which is a feature of holistic cognition, while cubism is more abstract than the other art styles which chimes with analytic cognition. On the other hand, cubism is also marked by multiple perspectives, which would match holism, and the Japanese style of ukiyo-e woodblock prints is praised for its simplicity, presumably not including many additional items in the scenes which is not expected for an East Asian society. It would be an interesting venture to investigate if and how these movements differ in terms of face-to-frame ratio, relative horizon height and number of additional items.

time. Participants were from different cultural backgrounds and we asked in which country they lived up to the age of 14. Forty-three were from the UK, 2 were from Poland, one participant each was from the countries Austria, Malaysia, Pakistan, Russia and South Korea, and 10 had moved countries before the age of 14. Ages ranged from 18 to 22 (mean = 18.91, SD = 1.097). Per session up to 6 participants took part. This study was approved by the Queen Mary Research Ethics Committee, reference QMREC2011-5.

4.3.2 Materials

A print copy of the NEO-IPIP Questionnaire was used (Goldberg; Goldberg, et al., 2006, Appendix I), which evaluates personality in terms of the Big Five dimensions: Intellect/Imagination, Conscientiousness, Extraversion, Agreeableness and Emotional Stability. It comprises of 100 questions which are answered on a 5-point Likert scale. A portrait of one of the two experimenters was taken with a Sony camera with a zoom function, at a distance of 2.75 metres which was marked in tape on the floor. Landscapes were drawn on an A4 paper with a thick black frame around the outer edges, leaving an area of 25.7 cm x 17.1 cm for the drawing, as is also used in Appendix II. Elements that had to be included were at least a house, a tree, a river, a person and a horizon. In this drawing the horizon height and number of additional items was measured.

4.3.3 Procedure

Participants were received in the computer lab and allocated to a cubicle. The questionnaire was filled out on paper in the cubicle, and participants were taken to a nearby location to take the picture and draw a landscape. The experimenter showed each participant individually how to use the camera's zoom function, after which the

participant was asked to “take a photograph” of the experimenter at a marked distance of 2.75 metres. When a participant asked how they should take the photograph or draw the landscape, the reply was “in any way you want”. Each picture task had a time limit of 5 minutes and the questionnaire was set for 15 minutes. Per session, half the group would start with the questionnaire while the other half were taken away to make the pictures. While one of the picture subgroup was taking the photograph, the other participants would draw the landscape. The order in which tasks were done was randomised, as was the allocation of computers and which of the two experimenters took participants away or observed the questionnaire.

4.3.4 Analysis

Following the face-to-frame ratio method of Masuda et al. (2008), in each photograph the area of the face was determined by measuring the distance from the chin to the top of the head, including hair, and the longest horizontal distance across the face, excluding hair. The frame area was measured from the inner border of the frame. The face-to-frame ratio is calculated as (face length * face width)/(frame length * frame width). The horizon height in the landscape drawing was measured by drawing a straight line through the horizon so that the area of land above the line approximately equalled the area of air under the line, and then the mean distance from the bottom border to the line was measured. The number of additional items was counted. An additional item was any extra element that we did not specify as a requirement. Groups of connected items were counted as one item (e.g. a group of clouds), but loose individual items were counted as one item each (e.g. loose clouds dispersed along the sky). For the personality questionnaire all questions were reverse scored where necessary and summed per factor.

Data for most variables were normally distributed (Shapiro-Wilks tests resulting in $p >= .05$). Transforming the data for additional items and Agreeableness (square-root transformations) and the face-to-frame ratio (log transformation) resulted in normal distributions (Shapiro-Wilks tests $p >= .05$). Both transformed and raw data are reported in this analysis. The cultural background data showed too little variability for statistical analysis, and will not be analysed.

4.4 RESULTS

Analysis shows that Extraversion does not correlate with any of the picture measures (face-to-frame ratio: Pearson: $r = .116$, $N = 60$, $p = .376$, Figure 26; untransformed data: Spearman: $r_s = .178$, $N = 60$, $p = .174$; horizon height: Pearson: $r = -.01$, $N = 58$, $p = .94$, Figure 27; untransformed data: Spearman: $r_s = -.01$, N = 58, $p = .94$; additional items: Pearson: $r = -.03$, $N = 58$, p .821, Figure 28; untransformed data: Spearman: $r_s = -.145$, $N = 58$, p .276).

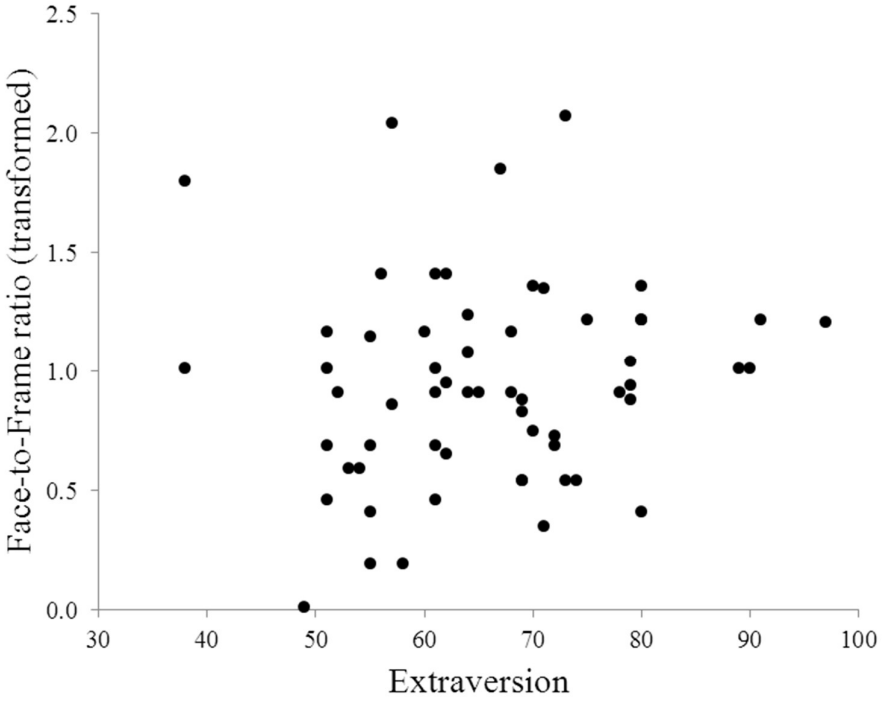

Figure 26: No significant correlation between Extraversion and Face-to-Frame ratio

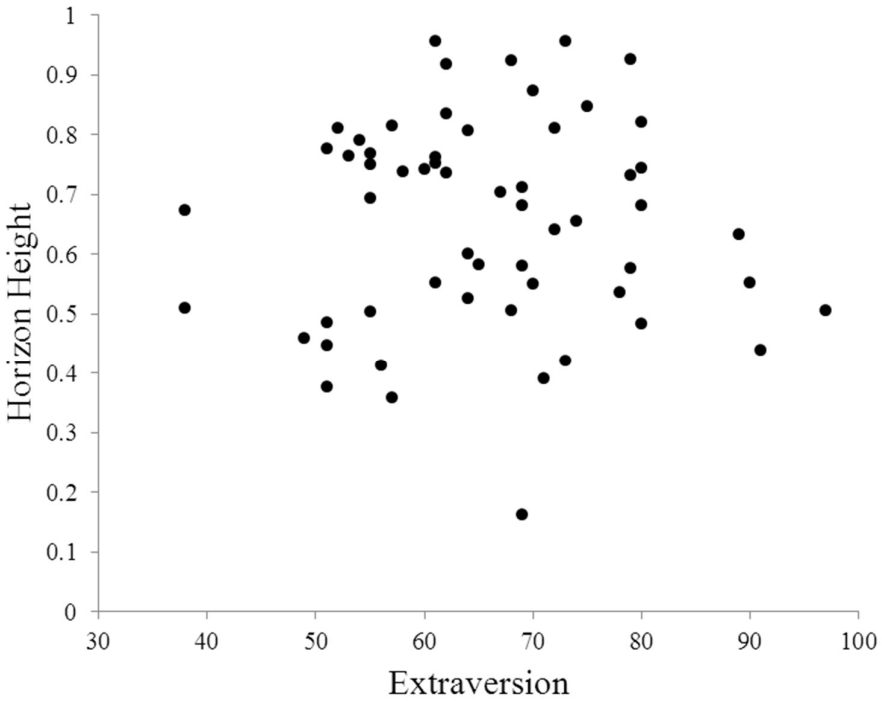

Figure 27: No significant correlation between Extraversion and relative horizon height.

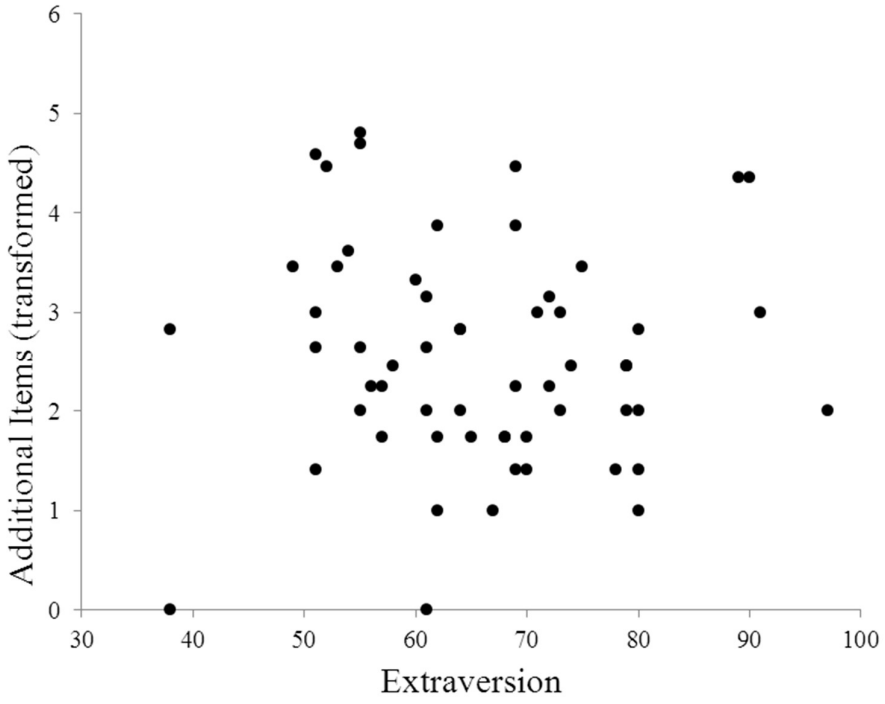

Figure 28: No significant correlation between Extraversion and additional items

Agreeableness correlates with the face-to-frame ratio (Pearson: $r = .330$, $N = 60$, $p < .01$; untransformed data Spearman: $r_s = .276$, $N = 60$, $p < .05$, Figure 29) but not with either of the other picture measures. None of the other personality factors (Conscientiousness, Emotional Stability or Intellect/Imagination) correlate with any of the picture measures.

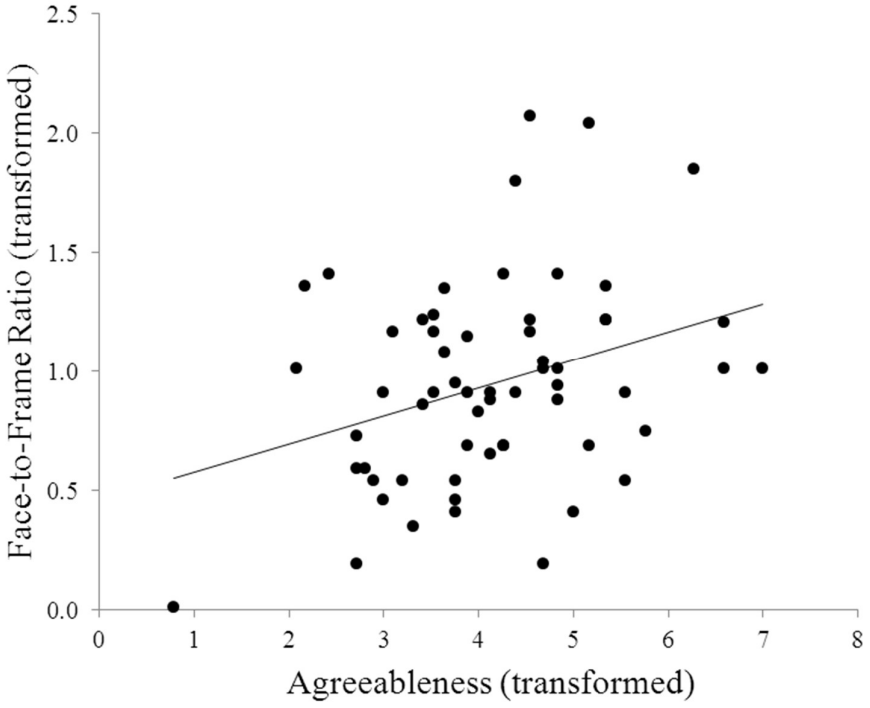

Figure 29: Significant and positive correlation between Agreeableness and face-to-frame ratio

Some effects are found that are not central to the hypothesis. As expected, among the primary DVs the face-to-frame ratio is negatively correlated to the number of additional items (r = -.268, N = 58, p < .05; untransformed data: r_s =-.236, N = 58, p = .074). However, contrary to expectation, horizon height does not correlate with the face-to-frame ratio (r = .091, N = 58, p = .496; untransformed data: r_s = .001, N = 58, p = .995) or the number of additional items (r = .019, N = 58, p = .887; untransformed data: r_s = .007, N = 58, p = .958).

There were some sex differences. Males drew significantly higher horizons than females (males: M = .748, SD = .155; females: M = .630, SD = .171; Levene's test: F = .677, p = .414; independent samples t-test: t_{56} = 2.167, p < .05). Males also scored significantly higher on Emotional Stability (males: M = 70.083, SD = 8.480; females: M = 56.229, SD = 13.869; Levene's test: F = 4.595, p < .05; independent

samples t-test (equal variances not assumed): $t_{27.7} = 4.381$, $p < .001$). Controlling for sex did not result in any changes in the above findings; there were no effects except for a relation between Agreeableness and the face-to-frame ratio. Sex was not a predictor for the face-to-frame ratio ($F_{1,58} = .014$, $R^2 = 0$, $p = .906$), while adding Agreeableness significantly improves prediction ($R^2_{change} = .110$, $F = 3.543$, $p < .035$).

4.5 Discussion

We hypothesised that on an individual level analytic cognition would positively correlate with Extraversion, leading people who score higher on Extraversion to make pictures with larger faces, and draw landscapes with lower horizons and fewer additional items, than people who score lower on Extraversion. We did not find support for this hypothesis: Extraversion in our participants did not correlate with the face-to-frame ratio, relative horizon height, or number of additional items. That we find no support for our hypothesis might mean that analyticism in pictures and individualism occur together at the group-level, but not at the individual level (Na et al. 2010). That would make this link a cultural one, meaning it is not a by-product of cross-cultural differences in personality types, rather factors in the cultural environment of individuals influence this phenomenon most. Surprisingly, instead of a link between Extraversion and proxies of analytic cognition, we found a link between Agreeableness and the face-to-frame ratio (but not with the other two proxies). Participants scoring high on Agreeableness photographed larger faces than participants with low Agreeableness scores.

It is possible that this relationship is spurious given the multiple correlations run and the lack of a specific a priori prediction relating to Agreeableness, resulting in a Type I error. It is also possible that the lack of correlation found with

Extraversion is due to a Type II error, although the fact that the effect sizes are much smaller than those for Agreeableness is an indication of Agreeableness' greater importance. Further replications with larger and more diverse participant samples are needed to determine the robustness of these effects. Future studies might also use a range of measures of analytic-holistic cognition, beyond the picture tasks used here.

It is also possible that the link between Agreeableness and the face-to-frame ratio is due to another factor besides a cultural one. Several links are imaginable: if highly Agreeable people take a deep interest in other people, they might want to focus on faces more than people who score low on Agreeableness. Also: if highly Agreeable people are more focused on pleasing the experimenter than low Agreeable people, the high Agreeable people may have taken the instruction for the zoom function as an indicator that they were expected to zoom in (although we were consistent in setting the zoom level back to the middle for each participant). These reasons for a link between Agreeableness and a high face-to-frame ratio cannot with certainty be excluded. However, this would mean that the assumptions underlying the cultural differences found in the face-to-frame ratio would be incorrect, and analytic-holistic cognition is not the main determiner of the face-to-frame ratio, but Agreeableness is.

Assuming that the previous literature is correct in considering the face-to-frame ratio as a proxy for analytic-holistic cognition, and that the found correlation is robust, we can speculate on its basis. Agreeableness has no relationship with IDV, but correlates negatively with the Uncertainty Avoidance Index (UAI) and Masculinity/Femininity (Mas, Hofstede & McCrae, 2004). If the level of analyticism in portraits is related to the level of Agreeableness, one conclusion might be that the level of analyticism in pictures is not linked to IDV, but to UAI or Mas. Previous

research on analyticism in pictures by Masuda and colleagues (2008) was only *implicitly* linked to IDV (Morling & Lamoreaux, 2008) which they themselves have carefully avoided doing (Ji, et al., 2000; Kitayama, et al., 2003; Masuda, et al., 2008; Miyamoto, et al., 2006; Nisbett & Masuda, 2003). It is possible that IDV explains the differences in cognitive mode between Western and East Asian societies, but too few countries have been investigated to exclude explanation in terms of UAI or Mas. The relationship between cognitive mode and Hofstede's dimensions should be further elucidated by comparing levels of analytic/holistic cognition in countries specifically chosen to contrast on the range of IDV versus the range of UAI and Mas.

A recent finding by Jackson, Thoemmes, Jonkmann, Lüdtke, and Trautwein (2012) links the present study to findings in Chapter 3. These researchers measured personality in young German men over a period of six years, and found that people who went through military service were significantly less Agreeable than people who had served in a civil function. There was a self-selection effect where those who opted for military service scored slightly lower in Agreeableness than others at the beginning of the measured time period. This difference between the young men in military and in civilian service was much increased after service had ended, and persisted for the duration of the study, which was 5 years. This concurs with the results in this chapter and Chapter 3: people lower in Agreeableness made pictures with smaller faces, and smaller faces co-occur with long periods of war. Assuming these findings are not spurious, what the portraits series might represent is the effect of war on Agreeableness, which may have slowly decreased in the population as an increasing number of people experience war.

Another connection between the present study and Chapter 3 exists. Although not directly measured, Hofstede, et al. (2010) discuss war in relation to

UAI mediated by anxiety and stress levels. UAI correlates strongly to anxiety and stress (Hofstede, 2001,p. 182). Although UAI has not been measured for change over time, time series of anxiety and stress do exist. The countries in which WWII was fought showed elevated stress and anxiety levels during the war (Hofstede, et al., 2010, pp. 232-234). Although high UAI and Mas both co-occur with xenophobia and nationalism (Hofstede, 2001, pp. 175-176 and 196), relating to war UAI probably has a larger role than Mas (Hofstede, et al., 2010).

The lack of correlation between the face-to-frame ratio and relative horizon height that was found here adds to the result from Chapter 3, where a similar discrepancy between the two measures was found. Since in both studies the results for the face-to-frame ratios are in line with the literature it seems that the relative horizon height is not a good proxy for analytic/holistic cognitive mode. This view is further supported by results in the next chapter (Chapter 5).

In conclusion, no evidence was found for the inferred group-level relationship between Extraversion and analytic cognition in pictures to occur at the individual-level, but a relationship was found between Agreeableness and the face-to-frame ratio in pictures. On the group-level Agreeableness is related to UAI and Mas, but not to IDV (Hofstede & McCrae, 2004). Findings for cultural differences in face-to-frame ratios in the literature could be explained by IDV, UAI and Mas, depending on the exact countries measured. Therefore the conclusion is drawn that the assumed relationship between analytic/holistic cognition and IDV may be premature, and specifically links with UAI and Mas should be investigated. This alternative explanation for analytic/holistic cognition reinforces assertions from the field that other dimensions besides IDV should be given more thought (Kirkman, et al., 2006; Tsui, et al., 2007).

CHAPTER 5: THE EFFECT OF EXPERIMENTALLY INDUCED COOPERATION ON COGNITIVE MODE

5.1 ABSTRACT

The ecocultural hypothesis predicts that working alone induces an analytic cognitive mode, while working together induces a holistic cognitive mode. Here I test this prediction by priming participants either with working together in a group in a public goods game (PGG) or with working alone in a multi-armed bandit game (MAB). While previous studies have successfully primed cognition, this is the first attempt to use priming to test a specific hypothesis for the origin of analytic and holistic cognition, and the first use of economic games as primes. Shifts in cognitive mode are tested with three tasks before and after playing the game. Cognitive mode has been proposed to be underpinned by self-construal, so in addition participants completed two tasks that measure self-construal. No changes in cognitive mode were detected. Self-construal did not change in the cooperative condition, but in the solitary condition independent self-construal increased significantly as predicted. In conclusion, this experiment does not support the ecocultural hypothesis for the origin of culturally variable cognition. However, the use of economic games may have been a confounding factor, since priming for money increases independence, thereby negating any effects in the cooperative condition and increasing any effects in the solitary condition.

5.2 INTRODUCTION

The ecocultural hypothesis posits that the differences in contemporary modes of thought observed between Western and East Asian societies have their origin in the ecological niche in the distant past (Nisbett, 2003; for an in-depth discussion of

the ecocultural hypothesis see section 2.4.2). The hypothesis proposes a series of factors interlinked in a causal chain, as follows. In regions with land suitable for farming, farming will become the major means of subsistence. That makes people (i) sedentary because they need to tend their fields and storage barns and (ii) interdependent because of the large amount of work on the farm that needs to be completed collectively. Being sedentary means prolonged physical proximity, which leads to the establishment of close-knit social networks. The development of a tight social network may be helped by, or maybe even primarily caused by, being interdependent because of the large work-load. This social network makes people pay more attention to one's group-members, and induces other collectivistic elements of cognition, like being focused on relationships between things and people and seeing the whole instead of its parts. Of course, sharing work and being interdependent might also foster a focus on relationships, or prioritizing for the good of the group. Some evidence for this theory has been found: in an area in Turkey, farmers were more holistic than solitary fishermen (Uskul, et al., 2008). In summary, the theory is that working alone fosters analytic cognition, while working together fosters holistic cognition.

Some factors have been found to influence cognitive mode in a very direct fashion, through priming. For instance, priming with culturally relevant information such as street scene images or language induces change in cognitive mode, as does priming with socially relevant information such as social power (see section 2.3.1). These factors are constantly present in the environment and therefore have to be assumed to continuously reinforce cognitive mode. If working alone or together is responsible for cognitive mode, it should have as much influence as these other factors, if not more. Therefore I here use a priming paradigm to experimentally test if

cognitive mode can be changed on an individual level through type of work: that which requires cooperation or work that is done alone. As primes economic games are used, which have proven to be powerful tools for understanding and manipulating social interactions. To the best of my knowledge using economic games as primes is novel.

In the cooperative condition participants play a public goods game with punishment (PGG, see section 2.3.5), in which participants are tempted to defect, while the best long-term result would come from cooperating (Ostrom, 1998). With punishment, people typically maintain high levels of cooperation. In the solitary condition participants play a multi-armed bandit (MAB), which is played with no interaction with others. Both games are cast in a relevant food gathering scenario: collective farming in the PGG and solitary fishing in the MAB. According to the ecocultural hypothesis, participants should show a shift towards more holistic mind sets when cooperating, and a shift towards more analytic mind sets when playing solitarily.

To gauge participants' cognitive mode three measurements are used that have been found to effectively show a difference between East Asians and Westerners. Appendix II presents the tasks as they were given to participants. (1) Categorizing task (Ji, et al., 2004; Markman & Hutchinson, 1984): participants have to group a word with one of two others, and briefly explain their choice. For example: "Dog. To which does this word belong most: A. Cat, or B. Bone". East Asians were found to predominantly choose on thematic grounds through focusing on relationships while Westerners choose mostly on taxonomic grounds, focusing on categories. (2) Portrait choosing task (Masuda, et al., 2008): participants have to choose their preferred portrait photograph from a set of four, which differ in the ratio of subject to

background. East Asians choose mostly a small subject while Westerners choose a large subject. (3) Landscape drawing task (Masuda, et al., 2008): participants are asked to draw a landscape with at least a person, a house, a tree, a river and a horizon, within the frame on the paper given to them. East Asians generally draw a higher horizon and include more extra items than do Westerners.

In addition in(ter)dependent self-construal is tested since this has also been shown to differ between East Asians and Westerners (Markus & Kitayama, 1991), and has been argued to underpin mode of thought. In the fourth task I make use of work by Gardner, et al. (1999), who asked participants to circle all pronouns in a short narrative. Texts with only singular pronouns (e.g. "I") induced participants to report higher independent self-construal and individualistic values, while texts with only plural pronouns (e.g. "we") induced higher interdependent self-construal and collectivistic values. Here this task was modified to measure self-construal before and after playing the game. Participants were asked to think of a recent social occasion, and describe it in five sentences. The number of plural compared to singular pronouns used indicates the participant's in(ter)dependent self-construal. The fifth and last task measures self-construal in a direct manner, using a questionnaire (Grace & Cramer, 2003; Singelis, 1994), in which participants are asked to rate their values related to in(ter)dependence on a sliding scale, for example: "It is important to me to respect decisions made by the group".

In summary, it is predicted that the solitary prime (the Multi-Armed Bandit game) will cause participants' cognition to become more analytic and less holistic, and their self-construal more independent and less interdependent, and the collective action prime (the Public Goods Game) will have the reverse effect.

5.3 METHODS

5.3.1 Design

A 2x2 mixed design was adopted where the within-participant factor was priming (before vs. after) and the between-participant factor was condition (cooperative vs. solitary). The dependent variables were the answers on the five cultural tasks before and after playing the game. It was predicted that participants in the cooperative condition would shift their answers towards more holistic mode and increased interdependent self-construal, while participants in the solitary condition would shift towards a more analytic mode and increased independent self-construal.

5.3.2 Materials

The five tasks were presented in separate paper booklets (Appendix II). Tasks before and after playing the game were changed in content to prevent participants from automatically filling in answers (versions 1 and 2 in Appendix II). Ten trios of words for the categorization tasks were adapted from Markman and Hutchinson (1984) and in addition I asked for a brief explanation of the participants' choice, to check if the reasoning indeed was based on thematic or taxonomic grounds (e.g., 'dog' may have been paired to 'cat' instead of 'bone', which might seem like a taxonomic or analytic choice, while the participant was thinking of the thematic or holistic reason: 'the dog chases the cat'). In the task after the game, ten different trios of words were used. In the portrait choosing task, five sets of portrait pictures were manipulated in Photoshop to have a person appear in different sizes in a background. Face-to-frame ratios were taken from Masuda, et al. (2008). After the game, persons and backgrounds were presented in different combinations. In the pronouns task participants were asked to think of a recent social occasion which they enjoyed, and

describe what happened in five sentences. Participants had 5 lines for their description and different examples before and after the game were given with equal numbers of singular and plural pronouns. In the landscape drawing task participants were presented with an A4 paper with a 1 inch black frame. Participants were asked to draw a landscape including at least a barn, a tree, a cow, a road and a horizon, or at least a house, a tree, a river, a person and a horizon. There were checkboxes in the lower left hand corner to remind participants of what to draw. For the values questionnaire, questions from Singelis' (1994) independent and interdependent self-construal questionnaire were used. This questionnaire had twelve questions in both the interdependent and independent categories. Grace and Cramer (2003) re-analysed the questions with factor analysis and found that eight questions (four out of each category) clustered into a third group which they interpreted as relating to hierarchy (similar to power distance in Hofstede, 2001). This third group also showed a significant sex-difference; therefore we did not use these questions. Questions were answered on an X-point Likert scale with extremes "I completely agree" to "I completely disagree". Half the questions were given before the task, the other half after the task.

The parameters for the PGG were adjusted for different group sizes (Table 5, for screenshots of the PGG see Appendix III). Participants were told they were farmers who had enough seed to plant twenty acres of land per season (endowment E). They had to decide whether to plant seeds in their private land, or to plant it in the communal land. The communal land has the benefit of shared responsibilities and therefore yielded more crop per acre planted than did the private land (multiplication factor b). They could punish each other for not planting enough seeds in the communal area (punishment P). Each unit of their crop they put towards

punishing another was multiplied by three (punishment multiplication factor Pmf). Participants could see in each round how many units of seed other players had planted in the communal land, but they could not identify other players and were told the order in which contributions were presented changed between seasons. Players could see the history of their scores in a table on the right hand side of the screen. The game lasted for 10 seasons, but to avoid a change of tactics in the final round participants were told they would play between 8 and 12 seasons, depending on how much time was left.

Table 5: Parameters in the public goods game.

Group size	Endowment	Multiplication factor	Punishment	Multiplication factor punishment	Conversion rate
N	E	B	P	Pmf	(pence/unit)
3	20	1.5	0-10	3	1.5
4	30	2	0-15	3	0.8
5	20	2.5	0-10	3	1

In the multi-armed bandit game (MAB) participants were told they were fishermen and they had to catch fish every day to feed their family and sell on the market (for screenshots of the MAB see Appendix IV). There were four rivers: North, South, East and West, only one river per day could be fished from. The quality of the rivers changed: on any day, there was only one river that delivered large catches (between 5 and 9 fish) while the other three delivered only between 2 and 6 fish. On average a river would remain high yielding for five days in a row. After that the river would be depleted and another river would become the high yielding one. Every day the family needed to eat 3 fish, and the remaining number of fish would be sold against 1.25 pence per fish. At the end of 120 days the total profit of fishing was the participants' reward. Participants received all information in the instruction. Both games were coded and presented in Z-tree (Fischbacher, 2007).

5.3.3 Participants

Eighty-four participants took part in this study (68 female, 16 male). Data from two participants were discarded because more than one task was unfinished, leaving 41 participants in the cooperative condition and 41 in the solitary condition. Ages ranged from 17 to 38 (mean = 19.58, SD = 2.829). Per session 3 to 5 participants took part. Participants were asked to sign up as a group and therefore knew each other. All participants were students at Queen Mary University of London, most of which were bachelor students. Participants were paid between £4 and £10, depending on their score in the computer game. This study was approved by the Queen Mary Research Ethics Committee, reference QMREC2010/56.

5.3.4 Procedure

Upon entering the laboratory participants were allocated to a computer divided by a screen. Participants answered some background questions, gave their consent and filled out the five tasks in the paper booklet for which they had 10 minutes. Then they read an introduction to the computer game which included questions to check their understanding of the game. After checking that everyone could produce the right answers 2 practice rounds were played, followed by the rounds in which money could be made. After the game was finished, the second set of five tasks was filled out in the paper booklet which also took 10 minutes. Then participants were debriefed, paid and were free to leave. Sessions did not exceed one hour.

5.3.5 Coding

Besides a relative score, the pronouns task and values questionnaire also gave independent scores for each cognitive mode because scoring high on one mode does

not exclude a high score on the other mode. For these tasks I tested for a difference in each separate mode, and the relative score, before and after the game. In all tasks a higher score means a higher level of holistic cognition or interdependent self-construal, except for the measures singular pronouns and independent self-construal where a higher score indicates higher analytic cognition and independence.

In the categorizing task the variable was the number of thematic choices. In the picture choosing task the variable was the mean of choice in the five sets of pictures, where each face size was given a number (smallest face = 4, largest face = 1). In the pronouns task the variable was the ratio of plural to singular pronouns. For the horizon height, a line was drawn through the horizon that approximately had as much surface area under it as above it. The variable was the mean height of this line relative to the height of the drawing field. For the number of additional items all extra items except the obligatory ones were counted separately, except for groups of very simply drawn items, such as flocks of v-shaped birds and grass dispersed throughout the drawing. In the values questionnaire, the variable was the ratio of mean score on interdependent items to the mean score on independent items.

Some participants failed to do all tasks. The horizon height task was most often unfinished. One missing task was accepted, but data for two participants were excluded because they did not complete 2 or 3 tasks.

5.4 Results

Most data were non-normally distributed. Exceptions were in the cooperative condition the picture choosing task before playing the game, the number of additional items in the landscape drawing task, the separate measures in the pronouns task and the values questionnaire before and after playing the game (although not the ratios between the independent measures). Normally distributed

variables in the solitary condition were the picture choosing and horizon height tasks, and the independent measures for the values questionnaire, before and after playing the game.

5.4.1 Main effects

In the cooperative condition (Table 6), paired-samples t-tests and related-samples Wilcoxon signed rank tests showed that in none of the tasks was there a significant difference in answer before and after playing the game. In the solitary condition (Table 7) there was a significant change in the independent self-construal items in the questionnaire before and after playing the game, indicating a shift from less to more independence as predicted (before: M = .30, SD = .13; after M = .35, SD = .14; $t(39) = -2.150$, $p < .05$, two-tailed). There was also a significant change in the ratio of plural to single pronouns used before and after playing the game, again in the predicted direction from less to more independence (before: M = 3.44, SD = 4.55; after M = 1.25, SD = 1.30; $z = -2.734$, N – Ties = 38, $p < .01$ two-tailed). All other changes were non-significant.

Table 6: Differences in tasks before and after playing the game, cooperative condition.

Cooperative condition

T-tests	Before M	SD	After M	SD	t	df	p (two-tailed)
Singular pronouns	3.58	2.34	3.48	2.05	.218	39	.828
Plural pronouns	3.05	1.38	3.40	1.72	-1.110	39	.274
Independent self-construal	.32	.16	.31	.13	.542	40	.591
Interdependent self-construal	.41	.18	.41	.17	.279	40	.782
Wilcoxon signed rank tests	Before M	SD	After M	SD	z	N-Ties	p (two-tailed)
Categorisation	5.83	2.90	5.46	2.74	-1.255	30	.210
Picture choosing	3.00	.65	2.93	.73	-.091	35	.928
Horizon height	.57	.18	.61	.18	-1.633	29	.103
Additional items	5.86	3.91	6.45	5.82	-.013	26	.990
Pronouns Ratio	2.77	3.34	1.58	1.68	-1.770	38	.077
Self-construal ratio	2.53	4.25	1.60	1.08	-.849	41	.396

Table 7: Difference in tasks before and after playing the game, solitary condition.

Solitary condition

T-tests	Before M	SD	After M	SD	t	df	p (two-tailed)
Picture choosing	2.93	.67	3.04	.57	-1.269	40	.212
Horizon height	.66	.17	.70	.17	-1.577	38	.123
Independent self-construal	.30	.13	.35	.14	-2.150	39	.038
Interdependent self-construal	.35	.15	.36	.17	-.167	39	.868
Wilcoxon signed rank tests	Before M	SD	After M	SD	z	N-Ties	p (two-tailed)
Categorisation	6.90	2.00	6.49	2.15	-1.551	27	.121
Additional Items	5.05	3.71	6.50	4.86	-1.483	32	.138
Pronouns Ratio	3.44	4.55	1.25	1.30	-2.734	38	.006
Singular pronouns	3.17	2.38	3.37	2.19	-.237	36	.812
Plural pronouns	2.68	1.57	2.63	1.64	-.290	28	.772
Self-construal ratio	1.80	2.41	1.59	3.24	-1.290	40	.197

For comparing the two conditions, the change in answers for tasks before and after the game was calculated (after score – before score), and compared, using independent-samples t-test and Mann-Whitney U tests. There were no significant differences in changes between conditions (Table 8).

Table 8: Difference in change after playing the game between cooperative and solitary condition.

Cooperative vs. Solitary condition

T-test	Change coop cond		Change sol cond		t	df	p (two-tailed)
	M	SD	M	SD			
Independent self-construal	.15	.17	-.05	.14	1.802	79	.075
Mann-Whitney U tests	Change coop cond		Change sol cond		U	N	p (two-tailed)
	M	SD	M	SD			
Categorisation	-.37	2.42	-.32	1.89	822.50	82	.865
Picture choosing	.06	.63	-.10	.51	779.50	82	.569
Horizon height	.05	.139	.04	.16	551.50	69	.685
Additional Items	.59	6.45	1.45	4.25	470.50	67	.307
Pronouns Ratio	-1.20	3.91	-2.19	4.47	744	81	.473
Singular pronouns	.10	2.90	-.20	2.90	802	81	.864
Plural pronouns	-.35	1.99	.05	1.70	722	81	.345
Self-construal ratio	-.94	1.45	-.24	4.01	800	81	.850
Interdependent self-construal	.01	.22	-.00	.18	.806	81	.895

5.4.2 Task concurrence

To test if tasks measuring analytic vs. holistic cognition and in(ter)-dependent self-construal tap into the same underlying construct, answers from all participants before playing the game (i.e. before participants were primed) were analysed. No variables were normally distributed except for the picture choosing task, relative horizon height, and answers to the self-construal questionnaire. Out of all five tasks before the game, only the picture choosing task was correlated to the ratio of plural to singular pronouns ($r_s = .252$, $N = 81$, $p < .05$, two-tailed). For the

two tasks that could be split up in separate variables, the correlation between inter- and independent self-construal items was not significant (r = -194, N = 82, p = .081, two-tailed), but the correlation between singular and plural pronouns was significant (r_s = -.304, N = 81, p < .01, two-tailed). None of the separate variables were correlated to any of the other tasks.

5.4.3 Effects of earnings

Earnings in the cooperative condition (M = 7.52, SD = .81) were significantly higher than in the solitary condition (M = 7.00, SD = .61; Levene's test: F = .10.647, p < .005; Mann-Whitney U-test: U = 570, $N_1 = N_2 = 41$, p < .05, two-tailed). Controlling for the amount of money earned did not change the main results; there were no significant differences in change after playing the game between the cooperative and the solitary conditions.

5.5 Discussion

In the cooperative condition there were no significant shifts in cognitive mode or self-construal after playing the game. In the solitary condition participants showed a significant increase in independence score in both self-construal tasks: they used significantly more singular pronouns relative to plural pronouns, and scored significantly higher on the independent items of the questionnaire but not lower on the interdependent items, or the ratio between the two. Between conditions there were no significant differences in change to any of the tasks. Overall, the present findings do not support the hypothesis: the type of work does not immediately influence analytic and holistic mode of thought.

The study presented here indicates that working alone or together is not a priming factor in analytic or holistic cognition. Previous work has shown that

cognitive mode can be primed using culturally relevant information such as images of street scenes or language, and with socially relevant information such as social power (see section 2.3.1). This implies that the ecocultural hypothesis is incorrect (as also concluded in Chapter 3), since if other information has a greater capacity of changing cognitive mode than type of work has, then this other information will be a stronger driving force for the current cognitive mode. Previous studies finding type of work to co-occur with cognitive mode (i.e. Uskul, et al., 2008) have not shown causality of the factors, but only co-occurrence. Underlying causal factors such as language, street scene or social power may have been overlooked.

However, it is possible that the use of economic games played via the computer may not have the same effect as playing a game face-to-face. From PGG experiments we know that cooperation increases when communication or reputation building is possible (see section 2.3.5). Moreover, priming for individualism and collectivism, or in(ter)dependent self-construal has been achieved using group vs. individual primes. For instance, in a face-to-face market game involving between-group trading governed by rules vs. within-group trading based on reputations, Yamagishi and Suzuki (2010) found that the first condition increased independent self-construal, while the second condition increased interdependent self-construal. The difference with the present study may be that it dealt with direct contact which may make a qualitative difference to the process. On the other hand, Oyserman and Lee (2008) also describe effective primes using *imagined* groups. This raises the possibility that the PGG was not forceful enough in inducing cooperative behaviour because it failed to induce a real sense of 'group'. Participants may have been frustrated by others not contributing enough to their liking, or by being punished.

This may have led them to want to exit the group, hindering successful priming of interdependence.

The use of economic games as primes might have come with another confounding factor. In these games the goal is expressly to earn as much money as possible. Vohs, et al. (2006) showed that people primed for money showed increased independence in the form of self-sufficiency, expressed in the amount of help asked for and given, in terms of time, effort and money. This may have increased independency and independent self-construal in both conditions, negating any cooperative effect of the PGG and adding to any effect the MAB may have had. Although participants in the PGG earned significantly more money than participants in the MAB, controlling for the amount of money earned had no effect on shift of cognitive mode or self-construal. This indicates that if participants were accidentally primed for independence, the effect is due to the money based goal of the game and not to the amount of money earned.

Besides testing the effect of priming, this experiment also lent itself to investigating whether tasks designed to tap into the same underlying construct of analytic or holistic cognitive mode, did exactly that. Answers given to the first three tasks before playing the game were expected to correlate with each other. Also independent self-construal was expected to correlate with an analytic mode, and interdependent self-construal with a holistic mode. Contrary to expectations there was no task concurrence, as has since been found (Na, et al., 2010). Again, as in Chapters 3 and 4, face-to-frame ratios in portraits and relative horizon heights in landscapes did not correlate, once more affirming that relative horizon heights are not good measures of analytic/holistic cognitive mode. However, a significant correlation was found between the picture choosing task (cognitive mode) and the

pronoun task (self-construal): participants that chose pictures with smaller faces used a higher ratio of plural to singular pronouns. Due to the large number of comparisons, it is possible that this significant result is a Type I error. It is also possible that the lack of evidence for the hypothesis is due to a Type II error, although increasing the sample size may not change the direction of effects which are not clearly in line with the hypothesis. Future studies with a larger and more diverse sample size could investigate if this effect was spurious. Assuming the effect is robust, this finding confirms that analytic/holistic cognitive mode and self-construal are linked (Kühnen, et al., 2001; Kühnen & Oyserman, 2002).

In the landscape drawings relative horizon height did not respond to the experimental procedure in this task. Given that in Chapters 3 and 4 it also did not show any of the expected effects leads to the conclusion that relative horizon height is not a good proxy for cognitive mode, for reasons also touched upon in Chapter 3: it aims to approximate the number of additional items, items which might also occur above the horizon, and other factors besides included items might also cause horizons to be drawn higher or lower. Moreover, the number of additional items also did not respond to the procedure here, as it did not in Chapter 4. Possibly some factors other than cognitive mode play a role in the choice for more or less items, such as time to waste before the experiment is over.

In conclusion, the present experiment found that analytic and holistic cognition cannot be primed, or at least not with economic games, which does not support the ecocultural hypothesis. Playing a solitary multi-armed bandit game did increase participants' independent self-construal. The three tasks for cognitive mode do not correspond with each other, as has been found since (Na, et al., 2010). Furthermore I find that, in concordance with findings in Chapters 3 and 4, relative

horizon heights and number of additional items in landscape drawings are not good proxies for cognitive mode. The picture choosing task was correlated to the ratio of plural to singular, which provides further support for the link between analytic/holistic cognitive mode and self-construal. Future studies could further investigate the role of work type in the ecocultural hypothesis by using games that do not rely on earning money.

CHAPTER 6: CULTURAL INFLUENCES ON PUBLIC GOODS PROBLEMS

6.1 ABSTRACT

Cultural variation in Public Goods Game (PGG) contributions has been detected, but not explained in terms of cultural dimensions. Using previously published data I find that cross-cultural variation in contribution rates in the PGG with punishment correlates significantly negatively with tax evasion, indicating that the PGG with punishment is indeed a good model for real-life tragedy of the commons situations. This indicates that findings from studies on cultural influences on the PGG can be informative for cultural studies on tax evasion, and vice versa. The common cultural denominator between the public goods dilemma in real-life and the laboratory is found to be uncertainty avoidance, as measured by the Uncertainty Avoidance Index (UAI). This gives rise to the hypothesis that in one-shot PGGs without punishment, the lack of controllable circumstances (no agreed rules or leaders) leads people with high UAI to withhold contributions. This hypothesis is tested on an individual level in a series of one-shot PGGs without punishment, and comparison to two questionnaires. No correlations are found between both datasets. Obfuscating factors may have been the PGG set-up and choice of questionnaires.

6.2 Study 1: PGG and taxation - Cultural responses to public goods problems

6.2.1 Introduction

The Public Goods Game (PGG) was developed to study cooperation in humans (see section 2.3.5). Designed to mimic the tragedy of the commons, it concerns any situation in which it is less individually costly for a person in a group to take something from a common resource and to collectively risk depleting the resource, than it is to practice temperance (Hardin, 1968). In the PGG, players can choose to contribute any amount of their play money to a pot, which is multiplied and shared equally between all players, regardless of their contributions. Mathematical analysis predicts that *not* contributing any money to the pot is the best strategy because this leaves one with at minimum the endowment, and at maximum the endowment plus winnings from the group pot. This strategy is the Nash equilibrium which traditional economists call the rational strategy, but which may not be rational if one considers that people might maximise things other than earnings (as discussed in section 2.3.5). Indeed in experiments the majority of people do not follow the rational strategy: most start off cooperating and contributing something to the pot, but over time cooperation generally dwindles (Ledyard, 1995). When participants are given the extra option of punishing each other, i.e. paying a small fee to take a larger sum away from the person being punished, cooperation is generally maintained at high levels (Chaudhuri, 2011).

Most PGG results have come from Western countries and only in recent times has data been published from other parts of the world. Cross-cultural comparison studies have found that the amount of cooperation and punishment

participants give varies between societies (see section 2.3.5): for instance US participants give relatively high contributions while participants in Greece contribute very little. In most societies free-riders are punished but in some societies such as Greece and Russia in addition high contributors are punished by people who contributed *less* than them, so called anti-social punishment (Gächter & Herrmann, 2009; Herrmann, et al., 2008).

Both punishment of free-riders and anti-social punishment have been found to be influenced by various cultural measurements as found by cross-cultural psychologists (Herrmann, et al., 2008). Anti-social punishment correlates negatively with Hofstede's individualism (IDV, see section 2.3.3), and positively with uncertainty avoidance (UAI) and power distance (PD). These cultural dimensions seem to have a much stronger influence on anti-social punishment than on punishment of free-riders. On the latter, norms of civic cooperation seem to have a larger effect (Herrmann, et al., 2008 supporting material).

In contrast, cross-cultural variation in contributions have been shown to exist (Gächter, et al., 2010), but conspicuously lacking in the field is an analysis of *how* contributions are influenced by specific cultural measures. Gächter, et al. (2010) concluded that when the PGG is played without punishment, contribution levels are more dependent on individual differences than on cultural regions cf. Inglehart and Baker (2000, see section 2.3.3). When punishment is added to the PGG, cultural influences on participants' contributions increase five-fold (Gächter, et al., 2010). Then the researchers conclude that, on the basis of first round contributions being higher in the punishment condition than in the non-punishment condition, the awareness of punishment primes people to behave according to their cultural norms.

The question then is: how does culture influence contribution in the PGG? To answer this question I will draw from published PGG data, but also from a real-life tragedy of the commons situation: the tax system. More research using larger samples is available on cultural influences on tax paying and tax evasion, making it potentially a good resource for the current question. First I discuss and test the similarities of the tax system and the PGG. Second, to test which cultural dimensions influence both factors I draw from the literature on tax evasion and compare these measures to Hofstede's dimensions.

6.2.2 PGG contributions and tax evasion

At least in Western Europe contemporary tax systems evolved out of single tax events to help rulers fund inter-state wars, among other functions (Blom & Lamberts, 1999; Braddick, 1996). This indicates that at the root of the system lies the same principle as in the PGG: group members are asked to contribute to fund a common goal, from which all members will benefit. However, there is a strong incentive to free-ride, or evade taxes;[13] keeping one's money and benefiting from the group effort. The tax system would break down were it not for strong punishments for tax-evasion, which is also seen in the PGG: when punishment is possible less free-riding takes place. Although the PGG and the tax system are different in the sense that in the PGG individuals punish free-riders, while in the contemporary tax system the state punishes free-riders, from the free-riders' point of view the situation is the same: free-riding is followed by an increased chance of being punished. The contemporary tax system and the PGG played in the lab are similar in another way: a certain amount of anonymity. In both situations tax evaders and free-riders are fined

[13] Tax evasion and avoidance should not be confused. Tax evasion concerns the illegal refraining of reporting otherwise legal income over which tax should be paid, while tax avoidance is the use of legal constructions to avoid paying taxes (Andreoni, Erard, & Feinstein, 1998), such as setting up a subsidiary in a foreign tax haven.

impersonally, which increases the amount of cheating people do. Non-anonymity is an important factor in both cases: it has been shown to increase contributions to public goods games in the lab (Bohnet & Frey, 1999; Lamba & Mace, 2010), and in real life a mere picture of eyes on a wall can increase contributions to a common pot (Bateson, Nettle, & Roberts, 2006). If indeed the PGG correctly models the tragedy of the commons, its cross-cultural pattern should be similar to cross-cultural variation in tax-evasion.

Here I test whether cross-cultural contributions in the PGG are the inverse of tax evasion in real life – since tax compliance should mirror PGG contributions, so tax evasion should be the same as *withholding* PGG contributions. For PGG data I use Herrmann, et al. (2008) data from the supplementary material (see Table 9). For tax evasion data I use Schneider's (2004) measures as reported by Tsakumis, Curatola, and Porcano (2007). These measures are the estimate of all earnings from legal activities that are deliberately concealed from the authorities, as a percentage of GDP over the years 2000-2002. Table 9 lists measures for tax evasion and PGG contributions.

Table 9: Tax evasion measures (Schneider, 2004) and contributions in the public goods game (Herrmann, et al., 2008). N = game with no punishment, P = game with punishment option.

		First round contributions		Mean contributions	
Country	Tax evasion score	N	P	N	P
Australia	13.97	8.2	7.8	4.8	14.1
Belarus	49.27	12.8	11.8	10.5	12.9
China	14.37	10.1	9.9	8	13.9
Denmark	17.73	14.1	15.4	11.5	17.7
Germany	16.37	10.9	12.1	9.2	14.5
Greece	28.47	8.1	5.8	6.4	5.7
Russia	47.43	10.8	10.8	9.9	11.8
Saudi Arabia	19.07	8	6.1	7.6	6.9
South Korea	28.13	8.3	9.7	7.9	14.7
Switzerland StGallen	9.13	13.7	15	10.1	16.7
Switzerland Zurich	9.13	12.1	13.2	9.3	16.2
Turkey	33.2	8.9	6.5	5.4	7.1
UK	12.47	10.9	11.3	7	15
Ukraine	53.5	11	9.5	10.6	10.9
US	8.6	13	16	9.3	18

Correlation analysis (with .5 weighted cases for both Switzerland's measures) shows that tax evasion measures correlate significantly negatively with PGG contributions when punishment is possible, but not when punishment is not possible (Table 10).

Table 10: Contributions in the public goods game (Herrmann, et al., 2008) and tax evasion measures (Schneider, 2004). N = game with no punishment, P = game with punishment option. Reported are Spearman r values. N = 15, namely Australia, Belarus, China, Denmark, Germany, Greece, Russia, Saudi Arabia, South Korea, Switzerland/StGallen, Switzerland/Zurich (both tax evasion measures for Switzerland), Turkey, UK Ukraine and US. Significance levels: * p<.05, ** p<.005.

	First round contributions		Mean contributions	
	N	P	N	P
Tax Evasion	-.286	-.542*	.14	-.742**

This means that the higher the level of tax evasion in a country, the lower the level of contributions in the public goods game *with* punishment, but not *without* punishment. The PGG with punishment accurately models the real-life situation of taxation, while the PGG without punishment does not. Furthermore, first round contributions and mean of contributions show the same pattern in both conditions, suggesting that people start the game *expecting* the group to behave according to their experiences in real-life, as has been noted before (Binmore & Shaked, 2010; Henrich, et al., 2005).

6.2.3 Cultural influences on the PGG and tax evasion

Having shown the similarity in cross-cultural variation between contributions in the PGG and tax evasion, we can draw from the latter to better understand the former. Cultural influences on tax evasion have been studied in terms of Hofstede's dimensions. Among 50 countries, Tsakumis, et al. (2007) found that several cultural measures relate to tax evasion (controlling for GNP): tax evasion correlates positively to uncertainty avoidance (UAI) and power distance (PD), and negatively to individualism (IDV) and masculinity (Mas). The authors explain these findings in the context of the tax system. People in high UAI countries dislike ambiguity and do not trust their governments to spend the taxes in the right way, thus to avoid the uncertainty of what their money will be used for they evade paying taxes. People in high IDV countries view written law as applying to everyone equally, while people in low IDV countries are more likely to exempt themselves or their in-group from the law; hence the negative relation between IDV and tax evasion. In high PD countries, people accept that high status individuals have privileges beyond those of low status people, among which the increasing of personal wealth. Thus tax evasion correlates positively with PD. In high Mas countries the strong emphasis on

performance and achievement comes with intolerance for breaking the law and strong punishment. Therefore there is a negative relationship between Mas and tax evasion (Tsakumis, et al., 2007).

Richardson (2008) expands on this work by including three further country level variables; (i) the level of legal enforcement based on the rule of law, (ii) trust in the government and (iii) religiosity, as indexed by the World Bank (Kaufmann, Kraay, & Mastruzzi, 2005) and the World Values Survey (WVS, 2006). Richardson (2008) found that tax evasion decreased with increased levels of law enforcement, trust in government, religiosity and IDV, and decreased levels of UAI. Contrary to Tsakumis, et al. (2007) he did not find any influences of PD and Mas. A further improvement on the previous study was that findings were robust for two alternative measures of tax evasion.

To test if cultural dimensions have a similar influence on PGG contributions as on tax evasion, I analyse data for the 13 countries for which data is available in both sets (again with .5 weighted cases for Switzerland's two measures). Correlational analysis shows that contributions in the punishment condition correlate significantly negatively with UAI and PD (Table 11). In the non-punishment condition, there is a significantly negative correlation with UAI *only* in the first round. Tax evasion in this sample shows the same pattern in relation to Hofstede's dimensions as Tsakumis, et al. (2007) found in their larger sample, indicating that the selection of countries analysed here is representative of those authors' larger selection.

Table 11: Correlations between contributions in the public goods game (Herrmann, et al., 2008), Hofstede dimensions (Hofstede, et al., 2010) and tax evasion (Schneider, 2004). N = game with no punishment, P = game with punishment. IDV = individualism, UAI = uncertainty avoidance, PD = power distance Mas = masculinity. Reported are Pearson *r* values, except for Tax evasion and Mas where Spearman r_s values are reported. N = 13, namely Australia, China, Denmark, Germany, Greece, Russia, Saudi Arabia (Hofstede dimensions for Arab countries), South Korea, Switzerland/StGallen, Switzerland/Zurich (both Hofstede dimensions for German speaking Switzerland, each weighted .5), Turkey, UK and US. Significance levels: * p<.05, ** p<.01, ***p<.005, [a] trend of p<.06.

Hofstede dimensions	No punishment		With punishment		Tax evasion r_s
	1st round	Mean	1st round	Mean	
IDV	.528	.108	.546	.568[a]	-.675*
UAI	-.580*	-.307	-.588*	-.710**	.681*
PD	-.572[a]	-.233	-.598*	-.633*	.609*
Mas r_s	.316	.032	.318	.302	-.751***

In the PGG with punishment, participants in countries with higher UAI and higher PDI make lower contributions. Interestingly in that condition, participants' first round contributions show the same effect, indicating that they start off playing according to expectations, as others have noted before (Binmore & Shaked, 2010; Henrich, et al., 2005). The mean contributions show the same pattern – even slightly stronger – indicating that there is no disintegration of the pattern as is usual without punishment, because participants use punishment to reinforce their countries' norms during the game.

In the PGG without punishment participants' average contributions to the pot are not correlated with scores on their cultural dimensions. Nevertheless, first round contributions do correlate significantly negatively with UAI. This result indicates that participants start the game according to expectations based on their society's culture in terms of UAI, but this effect disappears when the game proceeds. Most likely this occurs because of the lack of means to coerce fellow group members to behave according to norms. The original rational solution to the PGG comes back in

view: without any means of establishing or maintaining norms, contributions dwindle as predicted by the Nash equilibrium (Chaudhuri, 2011; Ledyard, 1995).

6.2.4 Discussion

Here I have shown that the PGG with punishment accurately models the tax system, which means that research on either topic can be informative for the other. The first study to date that investigates tax evasion in terms of Hofstede's dimensions (Tsakumis, et al., 2007) found that tax evasion correlates positively with UAI and PDI, and negatively with IDV and Mas. A follow-up study (Richardson, 2008) found the same effect for UAI and IDV, but not for PD and Mas.

Analysing PGG data from Herrmann, et al. (2008) for Hofstede's dimensions, I found the same pattern for UAI and PD in both first round and mean contributions in the punishment condition. This means that people start the game according to their cultural expectations, and are willing to enforce those expectations through punishment. Note that punishment does not vary much with cultural differences (Herrmann, et al., 2008), indicating that punishment is used in the same way across countries. I also found a correlation between UAI and first round contributions in the non-punishment condition, which indicates that UAI has a stronger impact on participants' game behaviour than the other cultural dimensions.

The small sample sizes in this study warrant a note on statistical power. The limiting factor was PGG data which has only been gathered in a small number of countries which increases the probability of a Type II error. The current method is only capable of detecting large effect sizes: I can only reliably detect effect sizes of $r = .66$ and higher for N = 15, and $r = .70$ for N = 13 (G*Power at a power of .80, Faul, Erdfelder, Buchner, & Lang, 2009; O'Keefe, 2007). The null-results might be spurious; future studies with PGG results from a larger number of countries will be

necessary. However, if the effect sizes would remain the same as found here when sample size would be increased, it is still clear that UAI has a larger effect on PGG contributions than the other dimensions do.

Overall the literature and the data presented here suggest that, of Hofstede's dimensions, the most stable influence of culture on public goods dilemmas is the level of UAI: the higher a country's UAI, the less participants contribute to the public good. What might be the reason for this? The economists discussed here put the cause with the level of generalised trust which works both ways (Richardson, 2008; Tsakumis, et al., 2007). The government does not trust the public and therefore imposes many laws and stipulations regarding everything including taxes. The public in turn finds the maze of rules confusing, the ambiguity of which entices them to evade taxes. Following the argument in the opposite direction; the public does not trust that the money collected by government will be used for worthy causes, and therefore is reluctant to pay taxes.

Several findings support this argument. UAI correlates negatively with generalised trust (Hofstede, 2001, p. 159), and corresponds with high numbers of rules in society (Hofstede, 2001, p. 147). However, if one takes Hofstede's own definitions (Hofstede, 2001, see section 2.3.3) we see that, as well as UAI correlating with a larger number of rules and laws, UAI also is paired with a higher need for morality, a higher belief in absolute truth and an intolerance for breaking the rules. Therefore the line of argument Tsakumis and Richardson present is not internally coherent: it invokes both high UAI's intolerance for ambiguity and low UAI's tolerance for breaking rules.

Based on the similarity of both mathematical structure and real-life pattern I propose that the primary causal mechanism that determines both lack of

contributions in the PGG and the tax system is the intolerance of ambiguity. The public goods game is usually played with unknown others, at screened off desks in a laboratory. In the game itself there are no rules specifying appropriate or inappropriate behaviour and there is no leader, nor are there any means of establishing such through verbal or non-verbal communication. The lack of communication in the public goods game might be a cause for uncertainty; it is an ambiguous situation, which people from high UAI countries are uncomfortable with. The real world tax system is also opaque. Citizens send money to unknown others and lose control over it. There is no way of communicating directly about the goals towards which one's money will be put. People in countries with high UAI should be expected to prefer having control over their money, which expressly does not mean they should want to keep it themselves, merely that they prefer to help others in a face-to-face, controlled way. For instance, they might be more focused on local networks of exchange, where known group-members exchange goods or services amongst themselves.

6.3 Study 2: Individual-cultural influences on PGG contributions

6.3.1 Introduction

From the literature study above I concluded that UAI was the most important factor in cross-cultural variance in contributions to the PGG. UAI expressed as a low tolerance for ambiguity can explain both real-world and laboratory based patterns in public goods dilemmas, because in both cases the lack of control over the future goal of money drives contributions down in countries with high UAI.

Here I test this hypothesis on the individual level in a repeated one-shot PGG without punishment, and two questionnaires that test the desire of control. This set-up is chosen because in the literature study UAI was the only cultural variable that correlated with first round contributions in PGGs without punishment, which means that other cultural dimensions will not be confounding factors. Two questionnaires were used: (i) the Uncertainty Avoidance scale which is suitable for individuals (Jung & Kellaris, 2004, Appendix V). Sample items are: "I prefer structured situations to unstructured situations" and "I tend to get anxious easily when I don't know an outcome". (ii) the Desirability of Control questionnaire (Burger & Cooper, 1979, Appendix VI). Sample items are: "I prefer a job where I have a lot of control over what I do and when I do it" and "When I see a problem I prefer to do something about it rather than sit by and let it continue". Some items are reverse scored. Both questionnaires are marked on a 7 point Likert-scale.

6.3.2 Methods

6.3.2.1 Participants

Participants were 40 undergraduate psychology students at Queen Mary University of London. The experiment was set within a larger experiment as part of their course work. In addition to payment for the larger experiment, participants were paid their profit in the PGG.

6.3.2.2 Materials

The PGG consisted of 20 one-shot rounds, with changing random group compositions per round. Each player had his/her private account and each group of 4 had a communal account. Endowment per round was 10 units which participants had to allocate to either their private pot or the public pot. Units in the private pots

counted directly to participants' earnings, while units in the public pot were multiplied by 2 and shared equally among all 4 players. Players were able to see their profits per round in a table on the right hand side of the screen. The conversion rate was 25 pence per 100 units. The PGG was coded with Z-tree (Fischbacher, 2007). Appendix VI shows screenshots for the PGG. Three questionnaires were filled in on paper: the Uncertainty Avoidance scale (Appendix V), the Desirability for Control scale (Appendix VI) and a third questionnaire: a Sense of Power scale that was not part of this experiment.

6.3.2.3 Procedure

Participants were received in the computer lab and allocated to a computer. Every other computer was left empty to decrease the possibility of participants communicating with each other. Participants received overall instructions and signed consent forms, and answered questions on cultural background: "In what country were you born?", "In what country were you raised before the age of 14?", "In what country were your parents born?", "In what country were your grandparents born?", "With which country do you identify most?". Half the students filled out the questionnaires on paper before playing the PGG, the other half filled out the questionnaires after playing the PGG. Demographic questions were answered immediately after having played the PGG. After finishing the experiment, participants were paid, debriefed and free to leave.

6.3.2.4 Analysis

All data were normally distributed, except first round contributions (Shapiro-Wilk tests $p < .05$). One participant left the study before filling out the questionnaires, leaving 39 participants. Three participants did not answer all items

for the Desirability of Control questionnaire, making it impossible to calculate the sum score and leading to exclusion from the analysis. Variation on the cultural background questions was not sufficient, thus these variables were omitted for analysis. Correlation analysis was used.

6.3.3 Results

The sum answers to the Uncertainty Avoidance scale did not correlate with either first round contributions in the PGG (r_s = .072, N = 39, p =.661) or mean contributions (r = .14, N = 39, p = .394). Sum answers to the Desirability for Control questionnaire also did not correlate to either first round contributions (r_s = .015, N = 36, p = .929) or mean contributions in the PGG (r = -.03, N = 36, p = .851). There was a significant effect of experimental order, where participants who played the PGG before filling in the questionnaires scored significantly higher on the Desirability of Control scale (M = 94.714, SD = 15.519) than participants who filled in the questionnaires first (M = 85.182, SD = 10.996; Levene's test: F = 2.588, p = .117; independent samples t-test: t_{34} = 2.159, p < .05). Controlling for experimental order did not result in any changes to the above results.

6.3.4 Discussion

The hypothesis was rejected: participants' Uncertainty Avoidance score had no relation to their first round contributions or the mean of their contributions in the PGG. Their Desirability for Control score also had no relation with first round or mean contribution. These findings suggest that low tolerance for ambiguity has no impact whatsoever on contributions in a PGG without punishment.

The implication of this finding is that the society-level correlation that was found in section 6.2 may only exist on the group-level, and may not exist on the

individual-level (Na, et al., 2010). Although some society-level variables are reducible to individual-level variables, such as personality, this is not always the case for other constructs, as for example for analytic/holistic cognitive mode (Na, et al., 2010, see also Chapter 5). It is possible that one or all of the factors investigated here - economic (game) behaviour, UAI or the two questionnaire variables individual-level UAI and Desirability of Control - are such constructs.

Before drawing any conclusions however, is should be pointed out that this study has two important methodological issues. The first is that this study may suffer from a Type II error. The sample size in this experiment is rather low (39 participants) giving rise to the possibility that the null findings are spurious. The set-up used here would only have been able to reliably detect effect sizes of .43 and higher (G*Power, Faul, et al., 2009), while the highest effect size found here is .14. This means that future studies should use larger sample sizes to reliably exclude an effect of desirability of control or uncertainty avoidance on cooperation in the PGG.

The second methodological issue is that the questionnaires might not be appropriate. The individual-level Uncertainty Avoidance scale has only been used by Jung and Kellaris (2004) and not others. The Desirability for Control questionnaire upon reflection is more on the topic of control over others, than on control over a situation; e.g. “I would prefer to be a leader rather than a follower”, “I consider myself to be generally more capable of handling situations than others are” and the reversed item “Others usually know what is best for me”. In hindsight, Matsumoto and Yoo (2006) recommend a number of questionnaires that correspond between individual and society level, one of which would have been more appropriate for the present study.

6.4 General Discussion

In the first part of this chapter I have examined cultural responses to public goods dilemmas, both in real-life situations (tax evasion) and laboratory based experiments (PGG). Literature study showed that the common denominator in both settings was UAI, where high UAI countries have high amounts of tax evasion and low amounts of contributions in PGGs with punishment. I hypothesised that the low tolerance of ambiguity in both cases leads to a reluctance to contribute to the public goods, because in both settings there is a lack of control; it is unclear beforehand what the fate of contributions will be.

In the second part of this chapter I tested this hypothesis in a series of one-shot PGGs without punishment, comparing contributions to answers on two questionnaires. Both sets of data showed no relation to each other, leading to the conclusion that it is not the lack of control or presence of ambiguity that influences the PGG. However, both the PGG set-up and the questionnaires may have been ill suited to answer this question. Improvements would include a larger sample size and more appropriate questionnaires.

CHAPTER 7: GENERAL DISCUSSION

> *"So East is East and West is West – for the moment. But the twain may meet in one or other of two ways. West may get so frightened of East that it will give up thinking that boys and girls are for mass consumption and decide instead that they're for cannon fodder and strengthening the state. Alternatively East may find itself under such pressure from the appliance-hungry masses who long to go Western, that it will have to change its mind and say that boys and girls are really for mass consumption. But that's for the future."*
>
> *Aldous Huxley, Island, 1962*

In his last novel written just before his death, Aldous Huxley incorporated many of the factors I have discussed in this thesis: a juxtaposition of West and East, elements of economy and war, child-rearing practices and relatively slow moving change in cultural attitudes. Half a century later we have gained a panoply of data on the content of culture, but little understanding of how, why and when cultures change, and indeed have only just started reporting *that* they change.

The rates and patterns of change in cultures are of vital importance for an understanding of culture as an evolving system. In Chapter 2, I argued that knowledge of the evolution of culturally diverse psychological constructs will be of benefit for understanding human evolution as a whole, and for facilitating a future situation where most people in the world have a high and stable level of well-being. At this moment cultural psychology is mostly still in stage 1 of inquiry (Heine & Norenzayan, 2006) which involves the observation of cultural variation in psychological phenomena. The field is ready to go into stage 2 which considers *how* these differences arose. A necessity for inquiry in this phase is to greatly diminish the number of variables the social sciences have uncovered and find the most

parsimonious description of the system (Matsumoto & Yoo, 2006). Reducing the number of variables involves finding overlap and gaps between dimensions, which will aid the synthesis of the social sciences. Synthesis in some form or another has been called for by scientists across fields of research (Ariely & Norton, 2007; Gintis, 2007; Mesoudi, Whiten, & Laland, 2006; Wilson, 1998). Stage 2 inquiry in cultural psychology can then be greatly advanced by cultural evolution models (cf. Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981).

The goal of this thesis was to contribute to stage 2 inquiry in cross-cultural psychology. For this goal I have (i) identified overlap and gaps in a range of culturally variable psychological cognitions (Chapters 2, 4 and 6); and (ii) investigated temporal patterns of one cultural dimension: analytic/holistic mode of cognition (Chapters 3 and 5).

In Chapter 2 I investigated several culturally variable psychological constructs for links and gaps, namely analytic/holistic cognition (Nisbett, et al., 2001), tightness/looseness of norm following (Gelfand, et al., 2011), Hofstede's multi-dimensional model (Hofstede, 2001), variation in personality (McCrae, Terracciano, & 78 members of the Personality Profiles of Cultures Project, 2005b), and one culturally variable behaviour not often considered by cultural psychologists: economic behaviour in the Public Goods Game (PGG, Gächter & Herrmann, 2009). I concluded that there seems to be a cluster surrounding high IDV; namely low PD, high analytic cognitive mode, and looseness of norm following (connected through independent self-construal), high GDP and low anti-social punishment in the PGG. A less clearly defined group of factors surrounded high Agreeableness, namely high contributions and low punishment in the PGG, and low UAI and Mas (Table 1).

In Chapter 3 I used a novel method to investigate temporal change in proxies of analytic/holistic mode of thought: portraits and landscapes, from the 15th century to the present day. For three countries, the Netherlands, England and Germany, I found the face-to-frame ratios and relative horizon heights in all three countries were dynamic, and not static over the centuries. This finding contradicts the patterns of cognition predicted by the ecocultural hypothesis (Nisbett, 2003), which therefore is not supported by this data.

The same dynamic change was found in the variations in face-to-frame ratio and relative horizon height within shorter time periods, which I used as a proxy for tightness/looseness in norm following. This dimension has been discussed as if it were static, for example by correlating present day scores for countries to population densities in 1500 (Gelfand, et al., 2011). The change I found does not concur with this view; tightness/looseness is more dynamic than previously thought.

Although all three proxies were more dynamic than expected, face-to-frame ratio and relative horizon height followed opposite trajectories: while the face-to-frame ratio started high (analytic), dropped to a low point (holistic) and then rose again, the relative horizon height showed the opposite and started holistic, dropped to analytic and ended up with holistic cognition. Since Masuda, et al. (2008) found low horizon heights for contemporary Western societies, and in Chapter 4 I also found a discrepancy between portraits and landscapes, I concluded that horizon heights as I have analysed them in this thesis were not representative of analytic/holistic cognitive mode.

Based on (selective) historical analysis, I concluded that the drop in analytic mode in the first half of the period under scrutiny corresponded with long periods of territorial war. A small number of studies investigate psychological change after

having experienced war, and find that stable change in in-group egalitarian cognition can occur if war was experienced within a developmental period of between 7 and 20 years of age (Bauer, et al., 2013). This developmental period would account for the relatively slow change in culture, and the requirement of long durations of the periods of war to induce change. A new field of research on historical dynamics, or the evolution of states (Turchin, 2003) indicated that understanding the cultural psychological processes that go with state formation would advance understanding of historical dynamics. If the findings in this chapter are verified in future research this could be of value to the field of historical dynamics, as well as for cultural psychology.

In Chapter 4 I investigated the link between analytic/holistic cognitive mode and personality. As discussed in Chapters 2 and 3, the face-to-frame ratio in portraits, and relative horizon height and number of additional items in landscapes, have been suggested to be a marker in analytic/holistic cognitive mode, and have subsequently been found to differ significantly between Western and East Asian societies (Masuda, et al., 2008). Also differing between these world regions are Hofstede's dimensions and aggregate personalities in terms of the Big Five dimensions. Dimensions of these last two constructs correlate with each other (Hofstede & McCrae, 2004), where IDV positively correlates with Extraversion (see Table 1). Since analytic cognitive mode and IDV have been argued to be closely related or even identical (Ishii, 2013), I hypothesised that individuals who prefer larger face-to-frame ratios in portraits, and lower relative horizon heights and fewer additional items in landscapes, would be more Extraverted than individuals who prefer the opposite.

In a laboratory experiment I found no evidence for this correlation, but instead found that participants who made portrait photographs with larger faces scored higher in Agreeableness. There were no relationships between any other factors. On a societal level Agreeableness correlates with Uncertainty Avoidance (UAI) and Masculinity/Femininity (Mas). Depending on exactly which societies are investigated, data that distinctly differs between the West and East Asia can be explained in terms of IDV, UAI *and* Mas. Assuming that this finding is not spurious (which future research will have to determine) then this might mean that analytic/holistic cognitive mode is linked to UAI or Mas rather than conventionally thought to IDV.

One recent study provides a link to the findings in Chapter 4. Jackson, Thoemmes, Jonkmann, Lüdtke, and Trautwein (2012) found that young men who had experienced military training had persisting decreased levels of Agreeableness compared to young men who had done civil service instead. This might indicate that what the portrait series of Chapter 3 show is changing levels of Agreeableness with long periods of war. A further supporting link can be found between UAI and war. Hofstede, et al. (2010) discuss the feedback effect between war and UAI mediated by stress and anxiety levels, but do not discuss war and any of their other dimensions.

Chapter 5 investigated a prediction made in the eco-cultural hypothesis: that working alone would induce analytic cognition, while working together would induce holistic cognition (Nisbett, 2003). I tested this prediction using economic experiments as primes: a PGG in the cooperative condition and a multi-armed bandit (MAB) in the solitary condition. Three tasks measured analytic/holistic mode of thought, namely a categorisation task measuring taxonomic vs. thematic choices (Ji,

et al., 2004), a portrait choosing task measuring the preferred face-to-frame ratio, a landscape drawing task measuring the relative horizon height and the number of additional items (Masuda, et al., 2008). Additionally I used two tasks that measure self-construal which has been argued to underpin analytic/holistic cognition: a short writing task measuring plural and singular pronouns (based on Gardner, et al., 1999), and a self-construal questionnaire (Singelis, 1994). To the best of my knowledge this is the first formal test of the ecocultural hypothesis in the laboratory, and the first time economic games have been used as primes.

I found that participants who played the PGG did not shift in answers to the tasks before and after playing the game, but participants who played the multi-armed bandit (MAB) showed increased independent self-construal after playing the game. There was little task concurrence, showing that one individual does not have an overall analytic or holistic mind set, but rather that people who score high on some measures can score low on others, as has since been found (Na, et al., 2010). The only relationship found was between the face-to-frame ratio and the ratio of plural to singular pronouns, which affirms previous research indicating a link between analytic/holistic cognitive mode and self-construal (Kühnen, et al., 2001; Kühnen & Oyserman, 2002).

An important methodological issue in this study was the nature of the economic games, which – in hindsight – conflicted with the function they should serve in the experiment. In these games the goal is to make money, but mention of money induces independence in the form of self-reliance in people (Vohs, et al., 2006). Using economic games may have negated any effects the PGG might have had and added to any effects the MAB might have had.

Chapter 6, part 1 investigated cultural responses to public goods dilemmas both in the laboratory (PGG) and in real-life (the tax system). Through literature study I found between-country negative correlations between tax evasion and contributions in the PGG with punishment, but not in the PGG without punishment. I concluded that the PGG with punishment is a good model for tax-paying, and that the study of each can be informative for the other. Using Hofstede's dimensions to investigate contributions in the PGG, I found that the common factor between cultural influences on the PGG and on tax evasion is UAI. Findings gave rise to the hypothesis that in one-shot PGGs without punishment, the lack of controlled circumstances (a lack of agreed rules or leadership) leads people with high UAI to withhold contributions.

Chapter 6, part 2 investigated this hypothesis on an individual level in a series of one-shot PGGs without punishment, and comparison to two questionnaires: an individual-level UAI questionnaire (Jung & Kellaris, 2004) and the Desirability of Control scale (Burger & Cooper, 1979). No correlations were found between the variables. Methodological issues were the choice of questionnaires and the set-up of the PGG. Possibly the choice to exclude punishment from the PGG did not reflect the findings in part 1, and led to a breakdown of cooperation among participants who scored low on UAI, thus impairing any patterns that may have arisen otherwise.

CONCLUSIONS

Several interesting conclusions can be drawn from the work presented in this thesis. The first is that the temporal patterns of two cultural constructs, analytic/holistic cognition and tightness/looseness, were found to be dynamic in terms of centuries and not static, as has widely been assumed (Chapter 3). The second is that the ecocultural hypothesis has not been supported (Chapters 3 and 5).

Third, the face-to-frame ratio in portraits does not measure the same construct as the relative horizon height (Chapters 3, 4 and 5) and the number of additional items (Chapters 4 and 5) in landscapes. Fourth, the PGG with punishment is a good model for a real-life tragedy of the commons: tax evasion (Chapter 6).

The synthesising approach at the basis of this work has resulted in the advancement of the second, less clear, cluster I identified in section 2.3.6, that of high Agreeableness, PGG behaviour of high contributions and low punishment, and low UAI and Mas (Table 1). Taking the face-to-frame ratio in portraits as a proxy for analytic/holistic cognitive mode, I found links between Agreeableness and low face-to-frame ratios (Chapter 4), between low face-to-frame ratios and increased interdependent self-construal (Chapter 5), and an implied connection between the increasingly low face-to-frame ratios during long periods of war (Chapter 3). Further supporting findings were found in the literature between military training and decreased Agreeableness (Jackson, et al., 2012), between war and high UAI (Hofstede, et al., 2010), and between high UAI and low Agreeableness (Hofstede & McCrae, 2004). Taken together the cluster surrounding Agreeableness is expanded and reinforced, and includes low Agreeableness, high UAI, holistic mode, interdependent self-construal, increased war, and possibly in-group egalitarianism in the PGG – though this depends on the assumption that in a regular PGG the *lack* of contrast between in- and out-group makes low Agreeableness participants uncooperative, while the *added* contrast brings out their in-group egalitarianism (cf. Bauer, et al., 2013).

Linking back to the points made in section 2.5, I conclude that I achieved my goal of investigating at least some temporal patterns in culturally variable psychological constructs, and have used these to test evolutionary hypotheses

concerning these constructs. Based on the evidence I am compelled to conclude that cultures are changeable in terms of generations and not static over long periods of time. Therefore evolutionary hypotheses for cultural constructs should account for timescales and environment at the appropriate level: in terms of ecology and contemporary living environments.

Another point I made in section 2.5 that I have not made any advances in is taking into account cultural patterns from world regions other than Western countries and East Asia. To address this point I included cultural background questions in the experiments of Chapters 4, 5 and 6 asking participants where they, their parents and grandparents were from, where they grew up until the age of 14 and with which country they identified most. Despite the broad cultural background of our East London students, the range of countries was never broad enough for statistical analysis. Only directed selection of participants for the required cultural backgrounds could have prevented this, which will be an interesting avenue for the future.

A point from section 2.5 I did make progress on is giving more thought to cultural dimensions other than IDV. UAI has been a recurring factor and may be an interesting dimension for future investigation. UAI might be slightly different from Hofstede's other dimensions, in that it does not necessarily require a group of other people to be apparent. An aversion to ambiguous situations could apply to non-social situations just as well as for social ones, for example in not knowing if there will be a good harvest, or being uncertain if an economic crisis will cease or not. Conversely, the other dimensions all are specifically social, even in the case of high IDV: being defined as *not* part of a group is still being defined in terms of sociality. Therefore a dimension such as UAI might be an aggregate variable, while IDV, PD and Mas might be emergent variables (see section 2.5). If so, possibilities for cross-

species research open up: possibly UAI in animals could be translated as risk avoidance.[14] Another aggregate human variable has preceded this path: human personality also has its parallel in animal studies (Bergmüller, Schürch, & Hamilton, 2010; McNamara, Stephens, Dall, & Houston, 2009; Wolf, van Doorn, Leimar, & Weissing, 2007). Studying if UAI indeed is an aggregate factor, investigating its evolutionary origins and elucidating its knock-on effects on human culture could be an interesting future direction.

More questions have also arisen from this thesis. As already mentioned the face-to-frame ratio and the relative horizon height did not show the same patterns. I concluded that, based on the correspondence of the portrait data with Masuda et al.'s (2008) findings, relative horizon height as I have assessed them here did not measure analytic/holistic cognitive mode. However, might the discrepancy between my data and that of Masuda et al. (2008) be because of the different countries in which data was gathered? Masuda et al. (2008) collected their data from the Metropolitan Museum of Art in the USA, which has a wide variety of Western countries across Europe and including the USA, Canada and Australia. My data exclusively hones in on the Netherlands, England and Germany. It is possible that the pattern unearthed here does represent these countries accurately, but that in the Western European countries but not in general, there is a schism in the construct of analytic/holistic cognitive mode. Further research could focus on this aspect and investigate the pattern of portraits and landscapes over time in other countries, such as other Western countries, East Asian countries but importantly also countries from other parts of the world that have so far been neglected in this line of research.

[14] Of course in humans UAI is specifically not risk avoidance, as discussed in section 2.3.3, but since animals cannot *calculate* risk, any risk will translate to uncertainty.

Further future directions that may arise from this thesis could be the relationship between the cluster surrounding Agreeableness and its potential for measuring *asabiya*, or group-cohesiveness that is important in the formation of nations (Turchin, 2003). A connection here could on the one hand be fruitful for the field of historical dynamics, and on the other hand could further inform evolutionary hypotheses for cultural cognitive constructs. Turchin's (2009) work has further interesting connections to that presented in this thesis: he presents a verbal model in which nomadic pastoralists and farming communities arise side-by-side but at some point start experiencing competition. Under competitive pressure nomads will be banded together on their own volition, while agriculturalists will experience more coercion. Aspects of this theory are reminiscent of work on field-(in)dependence or analytic/holistic cognition among primitive societies (see section 2.4.2). Exploring how the findings connect to Turchin's work could be an interesting topic for future research.

Summing up, the field of cultural psychology together with other areas in the social sciences have amassed a treasure trove of data on most everything in which humans differ across cultures. For building evolutionary theories on why these many facets of human cognitive culture exist, it is necessary to take a distant vantage point and search for patterns through space and time. The discovery of such patterns would greatly advance our understanding of the evolution of human culture.

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APPENDICES

APPENDIX I: IPIP-NEO-PI PERSONALITY QUESTIONNAIRE

Questionnaire used in Chapter 4. From Goldberg, et al. (2006).

How Accurately Can You Describe Yourself?

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence.

Indicate for each statement whether it is 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of yourself**.**

	Very Inaccurate	Moderately Inaccurate	Neither Accurate Nor Inaccurate	Moderately Accurate	Very Accurate
1. Am the life of the party.	O	O	O	O	O
2. Insult people.	O	O	O	O	O
3. Am always prepared.	O	O	O	O	O
4. Get stressed out easily.	O	O	O	O	O
5. Have a rich vocabulary.	O	O	O	O	O
6. Often feel uncomfortable around others.	O	O	O	O	O
7. Am interested in people.	O	O	O	O	O
8. Leave my belongings around.	O	O	O	O	O
9. Am relaxed most of the time.	O	O	O	O	O
10. Have difficulty understanding abstract ideas.	O	O	O	O	O

11. Feel comfortable around people.	O	O	O	O	O
12. Am not interested in other people's problems.	O	O	O	O	O
13. Pay attention to details.	O	O	O	O	O
14. Worry about things.	O	O	O	O	O
15. Have a vivid imagination.	O	O	O	O	O
16. Keep in the background.	O	O	O	O	O
17. Sympathize with others' feelings.	O	O	O	O	O
18. Make a mess of things.	O	O	O	O	O
19. Seldom feel blue.	O	O	O	O	O
20. Am not interested in abstract ideas.	O	O	O	O	O
21. Start conversations.	O	O	O	O	O
22. Feel little concern for others.	O	O	O	O	O
23. Get chores done right away.	O	O	O	O	O
24. Am easily disturbed.	O	O	O	O	O
25. Have excellent ideas.	O	O	O	O	O
26. Have little to say.	O	O	O	O	O
27. Have a soft heart.	O	O	O	O	O
28. Often forget to put things back in their proper place.	O	O	O	O	O
29. Am not easily bothered by things.	O	O	O	O	O
30. Do not have a good imagination.	O	O	O	O	O
31. Talk to a lot of different people at parties.	O	O	O	O	O
32. Am not really interested in others.	O	O	O	O	O
33. Like order.	O	O	O	O	O
34. Get upset easily.	O	O	O	O	O
35. Am quick to understand things.	O	O	O	O	O
36. Don't like to draw attention to myself.	O	O	O	O	O
37. Take time out for others.	O	O	O	O	O

38. Shirk my duties.	O	O	O	O	O
39. Rarely get irritated.	O	O	O	O	O
40. Try to avoid complex people.	O	O	O	O	O
41. Don't mind being the centre of attention.	O	O	O	O	O
42. Am hard to get to know.	O	O	O	O	O
43. Follow a schedule.	O	O	O	O	O
44. Change my mood a lot.	O	O	O	O	O
45. Use difficult words.	O	O	O	O	O
46. Am quiet around strangers.	O	O	O	O	O
47. Feel others' emotions.	O	O	O	O	O
48. Neglect my duties.	O	O	O	O	O
49. Seldom get mad.	O	O	O	O	O
50. Have difficulty imagining things.	O	O	O	O	O
51. Make friends easily.	O	O	O	O	O
52. Am indifferent to the feelings of others.	O	O	O	O	O
53. Am exacting in my work.	O	O	O	O	O
54. Have frequent mood swings.	O	O	O	O	O
55. Spend time reflecting on things.	O	O	O	O	O
56. Find it difficult to approach others.	O	O	O	O	O
57. Make people feel at ease.	O	O	O	O	O
58. Waste my time.	O	O	O	O	O
59. Get irritated easily.	O	O	O	O	O
60. Avoid difficult reading material.	O	O	O	O	O
61. Take charge.	O	O	O	O	O
62. Inquire about others' well-being.	O	O	O	O	O
63. Do things according to a plan.	O	O	O	O	O
64. Often feel blue.	O	O	O	O	O
65. Am full of ideas.	O	O	O	O	O

66. Don't talk a lot.	O	O	O	O	O
67. Know how to comfort others.	O	O	O	O	O
68. Do things in a half-way manner.	O	O	O	O	O
69. Get angry easily.	O	O	O	O	O
70. Will not probe deeply into a subject.	O	O	O	O	O
71. Know how to captivate people.	O	O	O	O	O
72. Love children.	O	O	O	O	O
73. Continue until everything is perfect.	O	O	O	O	O
74. Panic easily.	O	O	O	O	O
75. Carry the conversation to a higher level.	O	O	O	O	O
76. Bottle up my feelings.	O	O	O	O	O
77. Am on good terms with nearly everyone.	O	O	O	O	O
78. Find it difficult to get down to work.	O	O	O	O	O
79. Feel threatened easily.	O	O	O	O	O
80. Catch on to things quickly.	O	O	O	O	O
81. Feel at ease with people.	O	O	O	O	O
82. Have a good word for everyone.	O	O	O	O	O
83. Make plans and stick to them.	O	O	O	O	O
84. Get overwhelmed by emotions.	O	O	O	O	O
85. Can handle a lot of information.	O	O	O	O	O
86. Am a very private person.	O	O	O	O	O
87. Show my gratitude.	O	O	O	O	O
88. Leave a mess in my room.	O	O	O	O	O
89. Take offense easily.	O	O	O	O	O
90. Am good at many things.	O	O	O	O	O
91. Wait for others to lead the way.	O	O	O	O	O
92. Think of others first.	O	O	O	O	O

93. Love order and regularity.	O	O	O	O	O
94. Get caught up in my problems.	O	O	O	O	O
95. Love to read challenging material.	O	O	O	O	O
96. Am skilled in handling social situations.	O	O	O	O	O
97. Love to help others.	O	O	O	O	O
98. Like to tidy up.	O	O	O	O	O
99. Grumble about things.	O	O	O	O	O
100. Love to think up new ways of doing things.	O	O	O	O	O

APPENDIX II: FIVE TASKS IN TWO VERSIONS

Tasks used in Chapter 5. Versions 1 and 2 were allocated randomly before or after playing the game.

Version 1

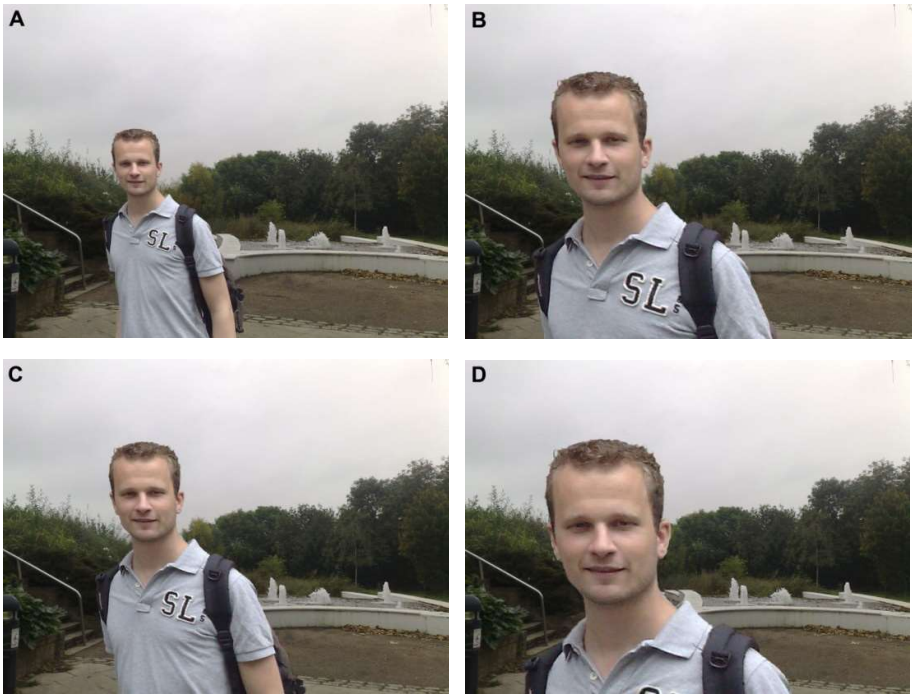
1. Which of the words belongs most to the first word? Please circle your choice and explain it very briefly.

	Choose between...		Please explain...
Dog	Bone	Cat	_____
Spider	Web	Grasshopper	_____
Police car	Van	Policeman	_____
Tennis shoe	Foot	Boot	_____
Labrador	Poodle	Dog food	_____
Birthday cake	Present	Muffin	_____
Cow	Pig	Milk	_____
Ring	Necklace	Hand	_____
Cup	Kettle	Glass	_____
Train	Bus	Tracks	_____

2. Please indicate which of each four pictures you like best.

Which picture do you prefer? A/B/C/D

Which picture do you prefer? A/B/C/D



Which picture do you prefer? A/B/C/D

Which picture do you prefer? A/B/C/D

Which picture do you prefer? A/B/C/D

3. Please think of a recent social occasion which you enjoyed, and describe what happened in five sentences.

Example:

1. Last weekend my friend and I decided to cook a meal.
2. We chose a recipe that I didn't know.
3. It took us ages to find the right ingredients for our meal.
4. We forgot to buy sugar, so we used sweeteners instead.
5. I thought the dish was great, but my friend said it was terrible.

1. _____

2. _____

3. _____

4. _____

5. _____

4. On the next page, please draw a landscape including at least a barn, a tree, a cow, a road, and a horizon. You can draw more things if you want to. Please keep the paper horizontal with the arrow pointing down.

Barn, tree, cow, road, horizon

5. Please mark your answer to the following questions on the scale, for example:

Ex: This instruction is clear

This marking means you think the instruction completely clear.

Please answer the following questions:

1. My personal identity independent of others, is very important to me

2. Having a lively imagination is important to me

3. I will stay in a group if they need me, even when I'm not happy with the group

4. I respect people who are modest about themselves

5. Even when I strongly disagree with group members, I avoid an argument

6. It is important to me to respect decisions made by the group

7. I feel comfortable using someone's first name soon after I meet them, even when they are much older than I am

8. I am the same person at home that I am at school

Version 2

1. Which of the words belongs most to the first word? Please circle your choice and explain it very briefly.

	Choose between...		Please explain...
Pigeon	Duck	Nest	_____
Door	Key	Window	_____
Monkey	Panda	Banana	_____
Coat hanger	Dress	Hook	_____
Cot	Bed	Baby	_____
Car	Garage	Bicycle	_____
Bee	Flower	Ant	_____
Shampoo	Hair	Conditioner	_____
Pen	Paper	Pencil	_____
Glove	Scarf	Hand	_____

2. Please indicate which of each four pictures you like best.

Which picture do you prefer? A/B/C/D

Which picture do you prefer? A/B/C/D

Which picture do you prefer? A/B/C/D

Which picture do you prefer? A/B/C/D

Which picture do you prefer? A/B/C/D

3. Please think of a recent social occasion which you enjoyed, and describe what happened in five sentences.

Example:

1 There was a movie that my friends and I wanted to see for some time.
2 Last Sunday we went, and I got us all the tickets.
3 We went for dinner before the movie.
4 As we expected the movie was great and we had a good time.
5 Because I had class the next morning I went home early.

1. _____

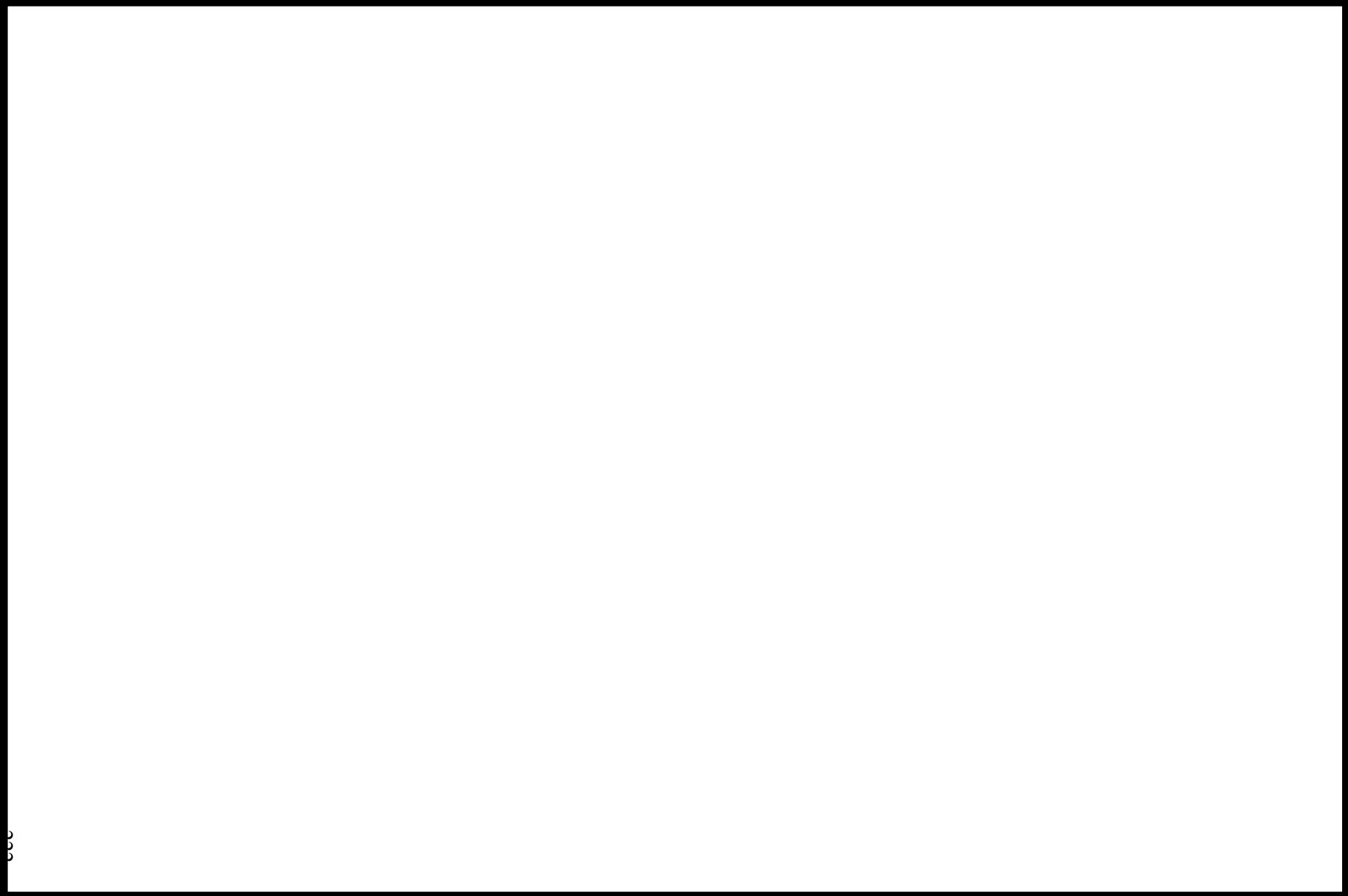
2. _____

3. _____

4. _____

5. _____

4. On the next page, please draw a landscape including at least a house, a tree, a river, a person, and a horizon. You can draw more things if you want to. Please keep the paper horizontal with the arrow pointing down.



House, tree, river, person, horizon

5. Please mark your answer to the following questions on the scale, for example:

Ex: This instruction is clear

This marking means you think the instruction completely clear.

Please answer the following questions:

1. If my brother or sister fails, I feel responsible

2. I often have the feeling that my relationships with others are more important than my own accomplishments

3. Being able to take care of myself is a primary concern for me

4. I prefer to be direct and forthright when dealing with people I've just met

5. I enjoy being unique and different from others in many respects

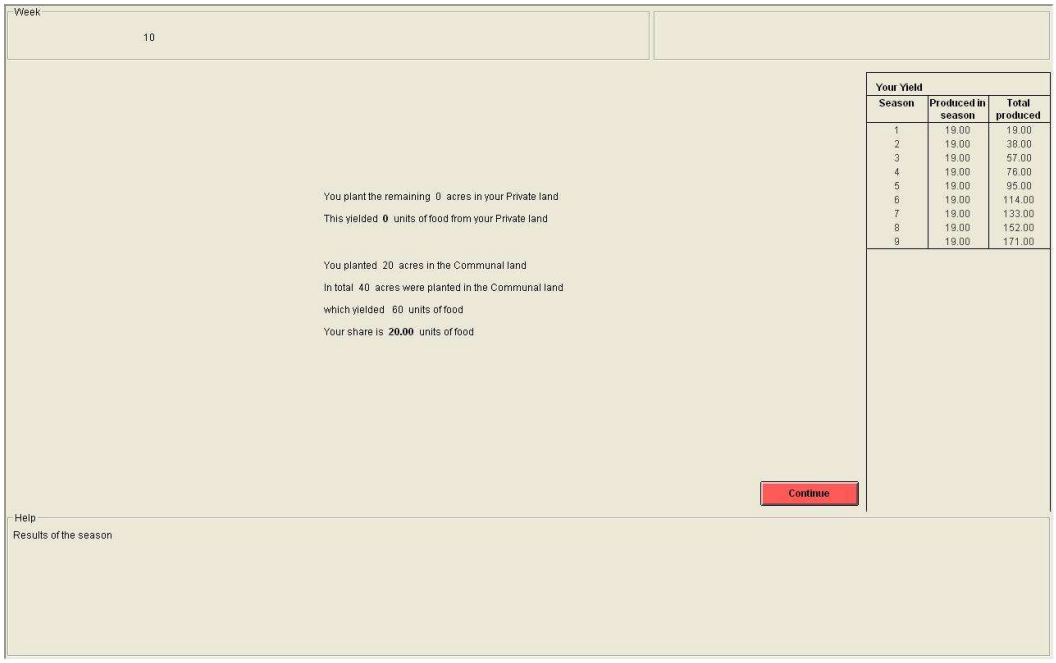
6. I should take into consideration my parents' advice when making education/career plans

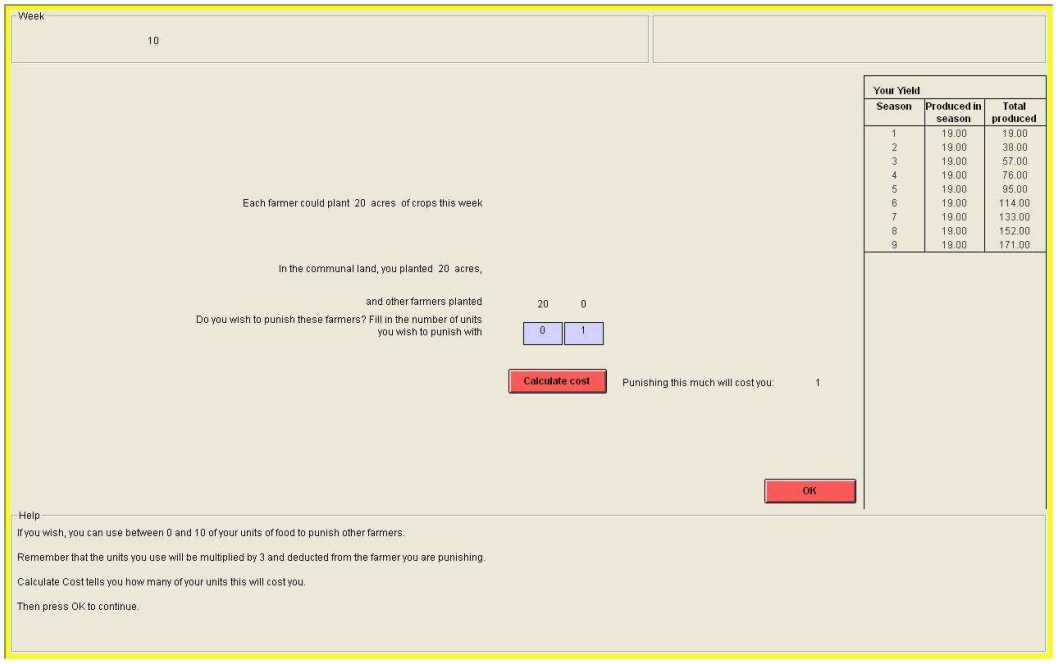
7. My happiness depends on the happiness of those around me

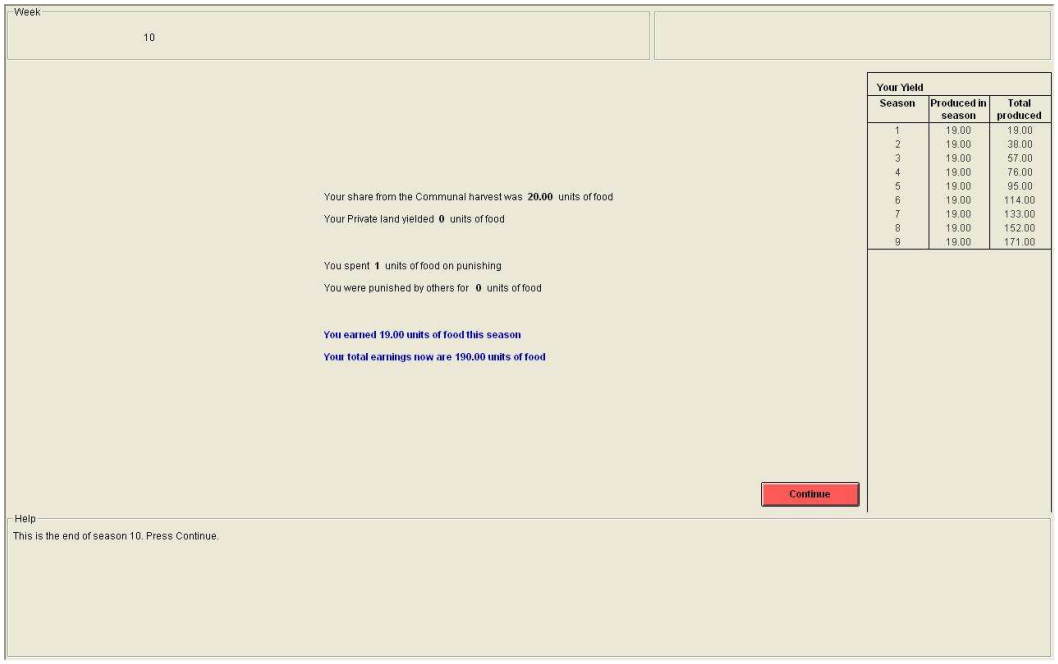
8. I am comfortable with being singled out for praise or rewards

APPENDIX III: PGG WITH PUNISHMENT SCREENSHOTS

The following are screenshots from the PGG with punishment as used in Chapter 5. In this - highly unlikely - scenario two participants are consistent full contributors of which one is a consistent punisher, and the third participant is a consistent free-rider.

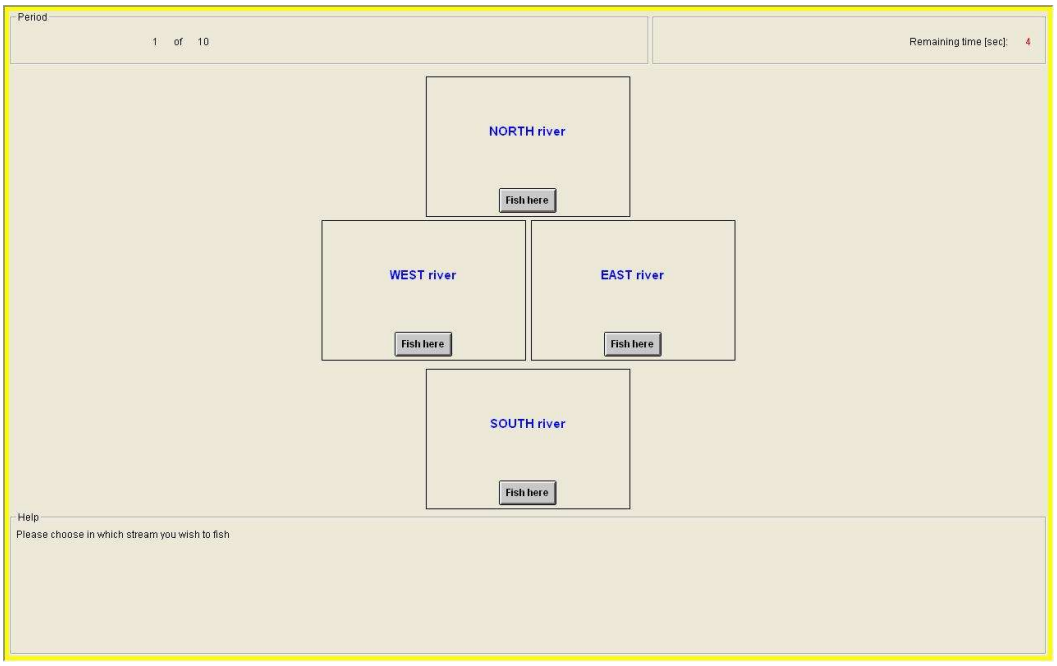

Week
10
Your Yield
Season | Produced in season | Total produced
1 | 19.00 | 19.00
2 | 19.00 | 38.00
3 | 19.00 | 57.00
4 | 19.00 | 76.00
5 | 19.00 | 95.00
6 | 19.00 | 114.00
7 | 19.00 | 133.00
8 | 19.00 | 152.00
9 | 19.00 | 171.00
You plant the remaining 0 acres in your Private land
This yielded 0 units of food from your Private land
You planted 20 acres in the Communal land
In total 40 acres were planted in the Communal land
which yielded 60 units of food
Your share is 20.00 units of food
Continue
Help
Results of the season

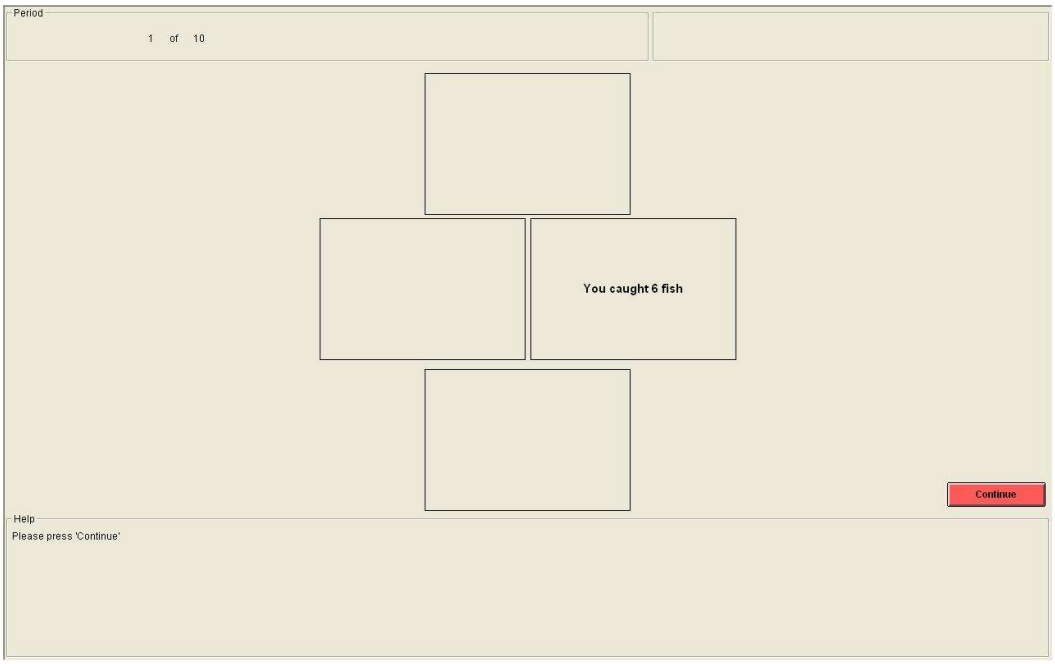

Week
10
Your Yield
Season | Produced in season | Total produced
1 | 19.00 | 19.00
2 | 19.00 | 38.00
3 | 19.00 | 57.00
4 | 19.00 | 76.00
5 | 19.00 | 95.00
6 | 19.00 | 114.00
7 | 19.00 | 133.00
8 | 19.00 | 152.00
9 | 19.00 | 171.00
Each farmer could plant 20 acres of crops this week
In the communal land, you planted 20 acres,
and other farmers planted
20 0
Do you wish to punish these farmers? Fill in the number of units you wish to punish with
0 1
Calculate cost
Punishing this much will cost you: 1
OK
Help
If you wish, you can use between 0 and 10 of your units of food to punish other farmers.
Remember that the units you use will be multiplied by 3 and deducted from the farmer you are punishing.
Calculate Cost tells you how many of your units this will cost you.
Then press OK to continue.


Week
10
Your Yield
Season
Produced in season
Total produced
1 19.00 19.00
2 19.00 38.00
3 19.00 57.00
4 19.00 76.00
5 19.00 95.00
6 19.00 114.00
7 19.00 133.00
8 19.00 152.00
9 19.00 171.00
Your share from the Communal harvest was 20.00 units of food
Your Private land yielded 0 units of food
You spent 1 units of food on punishing
You were punished by others for 0 units of food
You earned 19.00 units of food this season
Your total earnings now are 190.00 units of food
Continue
Help
This is the end of season 10. Press Continue.

APPENDIX IV: MAB SCREENSHOTS

The following are screenshots from the MAB used in Chapter 5.





APPENDIX V: INDIVIDUAL-LEVEL UAI QUESTIONNAIRE

Questionnaire used in Chapter 6. From (Jung & Kellaris, 2004).

Questionnaire 2

Please rate each of the items shown below using the following scale:

1 Disagree Strongly	2 Disagree	3 Disagree a little	4 Neither agree nor disagree	5 Agree a little	6 Agree	7 Agree Strongly

	1	2	3	4	5	6	7
I prefer structured situations to unstructured situations	○	○	○	○	○	○	○
I prefer specific instructions to broad guidelines	○	○	○	○	○	○	○
I tend to get anxious easily when I don't know an outcome	○	○	○	○	○	○	○
I feel stressful when I cannot predict consequences	○	○	○	○	○	○	○
I would not take risks when an outcome cannot be predicted	○	○	○	○	○	○	○
I believe that rules should not be broken for mere pragmatic reasons	○	○	○	○	○	○	○
I don't like ambiguous situations	○	○	○	○	○	○	○
	1	2	3	4	5	6	7

APPENDIX VI: DESIRABILITY OF CONTROL QUESTIONNAIRE

Questionnaire used in Chapter 6. From Burger and Cooper (1979).

Questionnaire 3

Please rate each of the items shown below using the following scale:

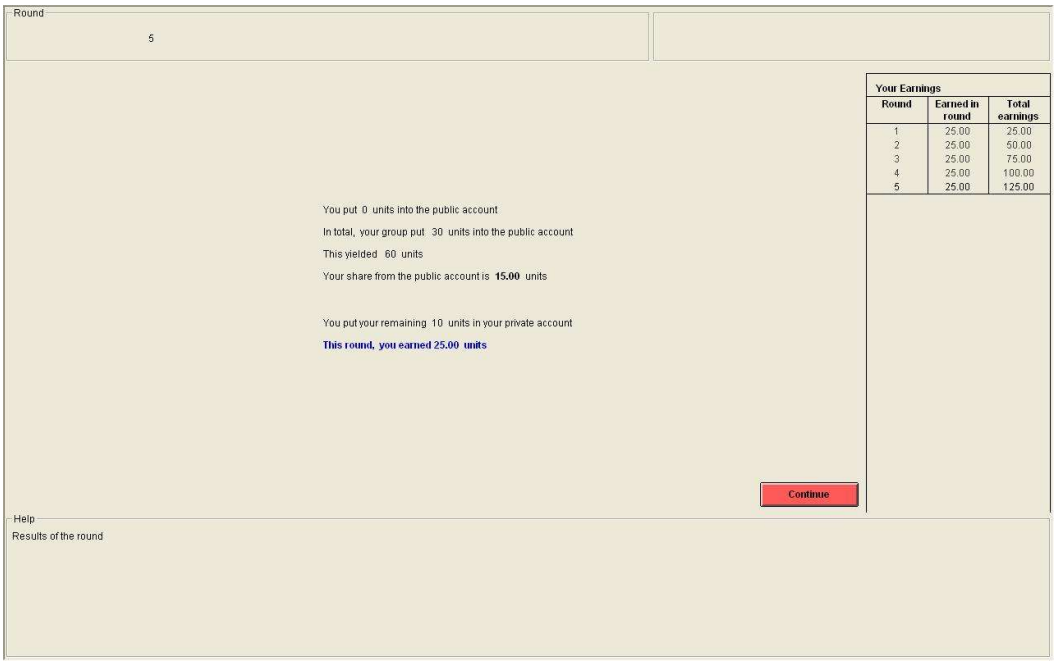
1 - The statement doesn't apply to me at all
2 – The statement usually doesn't apply to me
3 – Most often, the statement does not apply
4 – I am unsure about whether or not the statement applies to me, *or* it applies to me about
half the time
5 – The statement applies more often than not
6 – The statement usually applies to me
7 – The statement always applies to me

	1	2	3	4	5	6	7
I prefer a job where I have a lot of control over what I do and when I do it.	○	○	○	○	○	○	○
I enjoy political participation because I want to have as much of a say in running government as possible.	○	○	○	○	○	○	○
I try to avoid situations where someone else tells me what to do.	○	○	○	○	○	○	○
I would prefer to be a leader rather than a follower.	○	○	○	○	○	○	○
I enjoy being able to influence the actions of others.	○	○	○	○	○	○	○
I am careful to check everything on a car before I leave for a long trip.	○	○	○	○	○	○	○
Others usually know what is best for me.	○	○	○	○	○	○	○
I enjoy making my own decisions.	○	○	○	○	○	○	○
I enjoy having control over my own destiny.	○	○	○	○	○	○	○
I would rather someone else took over the leadership role when I'm involved in a group project.	○	○	○	○	○	○	○
Please continue overleaf	1	2	3	4	5	6	7

	1	2	3	4	5	6	7
I consider myself to be generally more capable of handling situations than others are.	○	○	○	○	○	○	○
I'd rather run my own business and make my own mistakes than listen to someone else's orders.	○	○	○	○	○	○	○
I like to get a good idea of what a job is all about before I begin.	○	○	○	○	○	○	○
When I see a problem I prefer to do something about it rather than sit by and let it continue.	○	○	○	○	○	○	○
When it comes to orders, I would rather give them than receive them.	○	○	○	○	○	○	○
I wish I could push many of life's daily decisions off on someone else.	○	○	○	○	○	○	○
When driving, I try to avoid putting myself in a situation where I could be hurt by someone else's mistake.	○	○	○	○	○	○	○
I prefer to avoid situations where someone else has to tell me what it is I should be doing.	○	○	○	○	○	○	○
There are many situations in which I would prefer only one choice rather than having to make a decision.	○	○	○	○	○	○	○
I like to wait and see if someone else is going to solve a problem so that I don't have to be bothered by it.	○	○	○	○	○	○	○
	1	2	3	4	5	6	7

APPENDIX VII: PGG WITHOUT PUNISHMENT SCREENSHOTS

The following are screenshots from the PGG without punishment as used in Chapter 6, in the case where three participants consistently fully contribute, and one participant consistently free-rides.


Round
5
Your Earnings
Round
Earned in round
Total earnings
1 25.00 25.00
2 25.00 50.00
3 25.00 75.00
4 25.00 100.00
5 25.00 125.00
You put 0 units into the public account
In total, your group put 30 units into the public account
This yielded 60 units
Your share from the public account is 15.00 units
You put your remaining 10 units in your private account
This round, you earned 25.00 units
Continue
Help
Results of the round